AR TARGET SHEET

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SECTION 2 OF 2

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ATTACHMENT 6

DEVELOPMENT AND ANALYSIS OF NEW REMEDIATION CONCEPT

ATTACHMENT 6
DEVELOPMENT AND ANALYSIS OF NEW REMEDIATION CONCEPT

1.0 Introduction

A new remediation approach has been developed and agreed to by the Tri-Parties. This attachment to the sensitivity analysis defines the new remediation concept and provides an assessment of how the existing evaluation in the Process Document changes under the new remediation concept.

1.1 Basis of New Remediation Concept

The implementation of the new remediation concept is based on the outcome of the Tri-Party Unit Managers meeting (February 22). During the meeting, members of the Tri-Parties drafted language describing the new remediation concept. These concepts were formalized in an information sheet and delivered to the Hanford Advisory Board following the meeting. A copy of the information sheet is included as Exhibit A.

1.2 Documentation Road Map

The current FFS documentation consists of the following components:

- Process Document - Main body of document
- Appendix A - Development of Preliminary Remediation Goals
- Appendix B - Cost Estimate Summaries
- Appendix C - ARAR Tables
- Appendix D - Sensitivity Analysis (with Attachments 1 to 6)
- Appendix E - HR-1 Operable Unit FFS
- Appendix F - BC-1 Operable Unit FFS
- Appendix G - DR-1 Operable Unit FFS

With the exception of the Appendix D sensitivity analysis and Section 7 in Appendixes E, F, and G, all of the components listed above are based on the original exposure scenario (FFS Scenario); remediation of soils to support occasional-use of the land surface, and frequent use of the groundwater. As described in Section 1.4 of the Process Document, waste sites were categorized into waste site groupings based on the analogous site concept (Hanford Past-Practice Strategy), remedial alternatives were developed for the waste site groupings, and detailed and comparative analyses were completed. In the operable unit specific appendixes, a detailed and comparative analysis of each waste site was completed. If the individual waste site profiles match the Process Document group profile, the individual waste site plugged into the already completed analysis in the Process Document. If the individual waste site profile differed from the group profile in the Process Document, a detailed and comparative analysis was conducted based on site specific conditions.

In the main text of the sensitivity analysis, a range of exposure scenarios are examined to determine how the baseline evaluation in the Process Document would change under differing exposure scenario assumptions. This attachment to the sensitivity analysis examines how the baseline evaluation in the Process document would change under the new remediation concept introduced by the Tri-Parties.

Sections 1 through 6 of the operable unit specific FFS (appendices E, F, and G) are based on the original scenario (FFS Scenario), however, Section 7 of each operable unit specific appendix has been recently developed for the purpose of assessing how the baseline analysis (Sections 1 -6 of each operable unit specific appendix) changes under the new remediation approach.

In summary, the original documentation basis is maintained (i.e., the majority of the FFS documentation continues to be based on the original exposure scenario), and the documentation of the new remediation approach is provided in two new locations: 1) Attachment 6 of the sensitivity analysis, and 2) A new section 7 at the end of each of the operable unit specific appendixes.

1.3 Summary of Contents

This attachment to the sensitivity analysis contains the following additional sections:

Section 2.0 - Remedial Action Objectives and Goals
Section 3.0 - Detailed Analysis of Technical Alternatives
Section 4.0 - Comparative Analysis of Alternatives
Section 5.0 - Conclusions
Exhibit A - Tri-Party "100 Area Clean Up Information Sheet"
Exhibit B - Revised Input for the Summers Method Analytical Model

2.0 Exposure Scenario Development

The 100 Area Clean Up Information Sheet which was recently presented to the Hanford Advisory Board states that "In all instances the goal of the cleanup will be completed to a level that will not preclude any future use due to Hanford contaminants". The details of how cleanup levels would be implemented to meet this goal are provided below.

2.1 Protection of Human Health

Soils are to be remediated to protect human health. The regulatory basis for the protection of human health PRG are:

- State of Washington Model Toxics Control Act (MTCA) cleanup levels for organic and inorganic constituents in soil.

- EPA/NRC proposed 15 mrem above background standard for radionuclides in soil.

For the purpose of the FFS, the point of compliance for protection of human health is assumed to be 15 feet below the existing ground surface for inorganics and organics (MTCA cleanup levels) and radionuclides (15 mrem). this is consistent with the MTCA regulation summarized below.

> "For soil cleanup levels based on human exposure via direct contact, the point of compliance shall be established in the soils throughout the site from the ground surface to fifteen feet below the ground surface. This represents a reasonable estimate of the depth of soil that could be excavated and distributed at the soil surface as a result of site development activities."[WAC 173-340-740(6)(c)]

2.2 Protection of Ecological Receptors

As described in the Process Document, the protection of ecological receptors is assumed to be consistent with, and satisfied by, the protection of human health.

2.3 Protection of Groundwater and the Columbia River

The protection of groundwater and the Columbia River is delineated into two cases.

First, for waste sites where groundwater has not been previously impacted, soils would be remediated to protect groundwater such that contaminants remaining in soil do not result in concentrations in groundwater that could exceed Maximum Contaminant Levels (Safe Drinking Water Act).

Second, for waste sites where groundwater has already been impacted, soils would be remediated to protect the Columbia River such that contaminants remaining in soil do not result in an impact to groundwater such that Ambient Water Quality Criteria (Clean Water Act) are exceeded at the Columbia River. Establishing the protection of the Columbia River

PRG requires site specific modeling. Since the site specific modeling cannot be done at this time, the analysis of the new remediation concept is based on the first case (assumption that groundwater has not been impacted).

The Summers Method analytical model was used in the Process Document and Sensitivity Analysis to develop protection of groundwater PRG. Since these documents have been produced and reviewed by the Tri-Parties a number of modifications to the model input parameters have been made. The revised model has been incorporated as part of the new remediation concept. An explanation of how the model was revised is included as Exhibit B.

2.4 Preliminary Remedial Goals

With the exception of the MTCA cleanup levels, the preliminary remediation goals (PRG) for the new remediation concept are inherently site specific. The 15 mrem dose is based on the cumulative contributions from individual radionuclides. The mrem contribution from cesium may differ from site to site. The of protection of groundwater and the Columbia River PRG will also vary based on site specific physical features, analysis of past practice, and soil chemistry. For purposes of analysis presented in this attachment, the PRG for the modified frequent use scenario are assumed to be representative of the PRG for the new remediation concept.

3.0 Summary of Technical Alternatives

The alternatives developed in the current FFS were established by the screening performed in the *100 Area Feasibility Study Phases 1 and 2* (DOE/RL 199?). The phase 1 and 2 screening defined potentially applicable general response actions for 100 Area waste sites. This screening was performed prior to the recent LFI and QRA efforts, which provide additional data to further assess the applicability of these general response actions.

In the FFS report, alternatives consistent with the following general response actions were developed.

- No Action
- Institutional Controls
- Containment
- Removal/Disposal
- In Situ Treatment
- Removal/Treatment/Disposal

Initial consideration was given to the alternatives to ensure that the actions would provide adequate protection under the given land-use scenario. It was determined that the alternatives, as developed would allow protection under an occasional use scenario. The alternatives were subjected to an additional site specific applicability screening. For instance, it was established that the in situ vitrification (ISV) technology could only effectively contain contamination to a depth of 19 feet below the ground surface. Therefore, the ISV alternative was not analyzed in the detailed analysis for sites with contamination at a depth of greater than 19 feet. As stated in the NCP section 300.430(e)(9)(i) the detailed analysis shall be conducted on the limited number of alternatives that represent viable approaches to remedial action after evaluation in the screening stage. The detailed analysis documented in the FFS report evaluates the viable alternatives against the nine CERCLA evaluation criteria.

Since a new remediation concept has been established, the effectiveness of the viable alternatives must be considered again. Since the new scenario is based on cleanup which does not preclude any future use, remedial action which limits access or land use would not be compatible with the new scenario. In situ treatment alternatives (e.g. ISV and grouting) as well as containment are no longer considered viable alternatives because they preclude some types of future use. Additionally, the institutional controls alternative was not evaluated in detail in the Process Document because it was not considered applicable for any of the waste site groups. Therefore, the only alternatives evaluated in detail are no action, remove/dispose and remove/treat/dispose.

4.0 Detailed Analysis of Technical Alternatives

Section 5.0 of the Process Document presents a detailed analysis of the candidate remedial alternatives with respect to the nine CERCLA evaluation criteria. The seven criteria evaluated include the following:

Threshold Criteria

- Overall protection of human health and the environment
- Compliance with ARAR

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost.

The two remaining criteria, state acceptance and community acceptance, will be considered after regulatory and public comment on the proposed plan and FFS documents.

A re-evaluation of the viable alternatives in light of the new remediation concept is described in the following sections. The CERCLA criteria are evaluated by assessing the impacts of the new exposure scenario on the specific critical parameters. Critical parameters are defined as those elements of a remedial action that are significantly impacted by a change in exposure scenario.

4.1 Evaluation of Critical Parameters

The critical parameters include excavated volume, contaminated volume, duration of remedial action, percent of material that is treatable, and cost. The reason these parameters are significantly impacted by a change in exposure scenario is primarily because of their relationship to PRG.

The modified frequent use scenario evaluated in the Sensitivity Analysis is considered appropriate for the purpose of estimating the relative volumes, costs, and durations for the new remediation concept. The modified frequent use scenario considers frequent use of the first 15 feet of soil. The frequent use is based on a target risk of 1×10^{-6} for radionuclides and nonradionuclides. This approach is generally consistent with MTCA values for non-radionuclides. The 1×10^{-6} target risk for radionuclides is more conservative than the 15 mrem values which are estimated to be comparable to a 1×10^{-4} risk.

The modified frequent use scenario does not consider contamination below 15 feet. However, the new scenario does consider contaminants at depth; the protection of groundwater addressed through the application of the revised Summers model. A preliminary assessment was conducted to determine how the revised model changed excavation depths at the four representative sites. The results indicate that the application of the revised summers model would not drive the excavation (at the four representative sites) deeper than 15 feet. Therefore, the volumes and costs of the modified frequent use scenario are acceptable substitutes for the new remediation concept.

The critical parameters are contaminated and excavated volume, duration, percent treatable, and cost. Each parameter is discussed in the context of the comparing the baseline (FFS scenario) with the new remediation concept below.

4.1.1 Contaminated and Excavated Volume

This is the quantity of material that must be addressed by the remedial action. The modified frequent-use scenario (new concept) results in a decrease in volume.

4.1.2 Duration

Duration is the amount of time required to complete the remedial action. This is an important parameter when considering short-term risks to workers from industrial hazards and exposure to contaminants. The modified frequent-use scenario (new concept) potentially results in a decrease in remedial action duration.

4.1.3 Percent Treatable

Percent treatable is the percentage of the contaminated material that can be treated by soil washing. The percentage represents the effectiveness of the treatment alternative under a given exposure scenario. Without specific PRG, the effectiveness can not be quantified at this time, however, as PRG become more stringent, the effectiveness (percent treatable) decreased.

4.1.4 Cost

The costs associated with the new remediation concept cannot be calculated directly because the PRG are not available. New scenario costs have been estimated by comparing the modified frequent use costs to the FFS. The new scenario costs for the remove/dispose and remove/treat/dispose alternatives are estimated to be 32 % and 30 % (respectively) less than the FFS scenario. These ratios were developed from the 100 area-wide roll-up costs presented in the sensitivity analysis.

4.2 Impact on the Evaluation of the CERCLA Criteria

This section identifies the impacts of changing the exposure scenario on the evaluation of the CERCLA criteria, as presented in the Process Document. The impacts are assessed for only those alternatives considered viable under the new scenario. The viable alternatives are no action, remove/dispose, and remove/treat/dispose.

4.2.1 Overall Protection of Human Health and the Environment

As exposure scenarios change, so do the remedial action objectives (RAO). As long as the RAO are met, the alternative is protective of human health and the environment; therefore, there is no significant impact on the evaluation of this criterion when alternative exposure scenarios are considered. The no action alternative would continue to not be protective of human health and the environment because contamination remains at the site. The remove/dispose and remove/treat/dispose alternatives would provide overall protection of human health and the environment at completion of the remedial action based on contaminant removal.

4.2.2 Compliance with ARAR

Even though the ARAR themselves may change as exposure scenarios change; ARAR will be considered either by meeting the requirement or obtaining a waiver. The remedial action will be designed and implemented in compliance with action-and location-specific ARAR, and cleanup criteria will be established in consideration of chemical-specific ARAR. The evaluation of this criterion will not likely be impacted by a change in the exposure scenario. The no action alternative would still not meet all of the applicable or relevant and appropriate requirements identified for remediation of the waste sites.

4.2.3 Long-Term Effectiveness and Permanence

The evaluation of this criterion will not be impacted by changing the exposure scenario. The no action alternative would still not be effective over the long term since the threat to human health and the environment is not adequately mitigated. The remove/dispose and remove/treat/dispose alternatives would be effective over the long term since contamination is removed from the waste site and placed in an engineered disposal facility for long term management.

4.2.4 Reduction of Toxicity, Mobility, and Volume through Treatment

The evaluation of this criterion will not be impacted by changing the exposure scenario. The no action alternative would not provide reduction of toxicity, mobility, or volume. The remove/dispose and remove/treat/dispose alternatives both continue to provide some reduction in mobility by placing the contaminated material in an engineered disposal facility for long term management. The remove/treat/dispose alternative includes the most significant level of treatment and may provide a reduction in the volume of contaminated material requiring disposal.

4.2.5 Short-Term Effectiveness

The evaluation of short-term effectiveness is impacted by changing exposure scenarios. As the volume of material to be addressed increases, the duration of the activity increases. This increases the risk to workers from industrial hazards as well as exposure to contaminants. As the extent of the excavation increases, there is an increased potential for disturbance of local ecological and cultural resources. The modified frequent-use scenario resulted in much less excavated material, which results in a decrease in remedial action durations. The no action alternative still would not result in adverse impacts to workers during implementation since no actions would be performed, however the existing threats to human health and the environment would remain. The remove/treat/dispose alternative would still result in risk to workers from the treatment process and require more time to implement. The remove/dispose alternative still requires less time to implement than the remove/treat/dispose alternative and still presents less short-term risks to workers.

4.2.6 Implementability

For the remove/dispose alternative, the evaluation of implementability is not impacted by changing exposure scenarios. The technology is proven, established, and readily implementable. The remove/treat/dispose alternative is impacted by the performance limitations of technologies, such as soil washing. For the alternative, as PRG become more stringent, the ability of soil washing to treat contaminants decreases, rendering the remove/treat/dispose alternative less implementable. The amount of soil that can be treated is the best indicator of the implementability of soil washing. The no action alternative would still be easy to implement since no actions would be required, however the potential threats posed by the waste site would remain.

4.2.7 Cost

Because of the relationship of cost to the volume of material treated, disposed and excavated, the evaluation of cost of the remedial action is very sensitive to changes in exposure scenarios. The modified frequent-use scenario results in less volume, which results in less cost. Section 4.1.4 establishes cost adjustment factors based on the results of the sensitivity analysis. These factors can be applied to the current cost estimates in the FFS to ascertain a new cost estimate suitable for comparison of alternatives under the new remediation concept.

EXHIBIT A

To: Hanford Advisory Board
From: Tri-Party Agencies
RE: 100 Area Clean Up Information Sheet

The information below concerns the clean up activities in the 100 area. This information is being faxed to foster discussions during Thursday afternoon's 100 area discussion. There are two pages to this fax.

Over the last several months the agencies have been working to develop clean up plans (i.e., proposed plans) for the first three operable units in the 100 Area. These units are 100-BC-1, 100-DR-1, and 100-HR-1. The proposed plans will focus on the radioactive liquid waste disposal sites such as cribs, trenches and retention basins. The solid waste burial grounds and septic tanks associated with these areas will be covered in subsequent plans.

There are approximately 30 waste sites that will be addressed in these plans. In earlier discussions with the board the agencies shared that the preferred alternative for the 100 area as a remove and dispose option. The discussions over the past several months have focused on issues such as cleanup levels, timing for the clean up, how reactor removal influences cleanup decision and early clean up.

The agencies have come to agreement on clean up levels for these waste sites. The State of Washington Model Toxic Control Act (MTCA) will be used to generate chemical/metals clean up levels. The agencies are considering the use of the proposed EPA and NRC standard of 15 mrem above background for the radioactive component clean up standard; this equates to a 10-4 clean up level under CERCLA. This also is consistent with EPA risk assessment methodology and the Hanford Risk Assessment Methodology. For sites that have impacted groundwater, the Freshwater Quality Criteria standards for protection of the Columbia River will be used to establish clean up levels. In sites that have not impacted groundwater the chemical specific Maximum Contaminant Levels under the Safe Drinking Water Act will be used.

In regard to the timing of clean up, the agencies believe that a phased approach should be used. Sites will be prioritized by size and location during the remedial design phase with an emphasis on sites that have impacted groundwater. The remedial emphasis on sites that have impacted groundwater. The remedial design phase occurs after the record of decision has been issued. Those sites that are in close proximity (50 meters has been discussed) of the reactor are proposed to be deferred for clean up until such time that the reactors are removed.

Removal of contaminants at deep sites will be determined on a case by case basis. Where appropriate, decay of radionuclides will be evaluated and balanced against protection of human health and the environment, costs, sizing of the ERDF, worker safety, disturbance of environmental and cultural resources, the use of institutional controls and long term monitoring considerations. In all instances the goal of the clean up will be completed to a level that will not preclude any future use due to Hanford contaminants.

The three agencies have been working with the Department of Energy Headquarters on a new project called the Streamline Approach for Environmental Restoration (SAFER). This approach combines the data quality objective method with the observational approach. The agencies plan on using this process to do remedial design and remedial action planning in order to begin remedial action at several key sites in the 100-BC area this summer. The three agencies will be involved in upfront planning for this project and will keep the board and affected Indian Tribes apprised of the progress of this project.

The schedule for the first three clean up plans is to have the proposed plans ready for the board at the April meeting. The agencies expect to begin public comment by mid-April with record of decision being issued this summer.

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EXHIBIT B - REVISIONS TO THE SUMMERS METHOD ANALYTICAL MODEL

This exhibit is a summary of revisions to the Summers model presented in the 100 Area Focused Feasibility Study for estimating contaminant concentrations in soil that are protective of groundwater protection values. The only changes made in this version of the model are: 1) use of a recharge rate to groundwater that better reflects hydrological conditions at the Hanford site. 2) reevaluation of soil/water distribution coefficients (K_d) for inorganic constituents. Review of available literature indicated that Kd values for 11 contaminants should be revised. All other parameters have remained unchanged from the version of the model originally published in the Focused Feasibility Study.

The recharge rate to groundwater originally used in the Summers model (10 cm/year) was discovered to be inconsistent with values typically observed at the Hanford site. The value used in the revised model (0.2 cm/year) is based on the results of long-term lysimeter studies performed at the Hanford site (Routson, R.C. and V.G. Johnson. 1990. Recharge estimations for the Hanford Site 200 Areas Plateau. *Northwest Science*. 64(3): 150-158).

The revised protection of groundwater PRG are summarized in the attached table. Documentation of the revised modeling assumptions and calculations is also attached.

PRGs Protective of Groundwater Quality

	Values Originally in FFS	Values Based on Revised Summers Model	Units
Am-241	31	3,756	pCi/g
C-14	18	2,320	pCi/g
Cs-134	517	62,600	pCi/g
Cs-137	775	93,900	pCi/g
Co-60	1,292	156,500	pCi/g
Eu-152	20,667	2,504,000	pCi/g
Eu-154	20,667	2,504,000	pCi/g
Eu-155	103,000	12,520,000	pCi/g
H-3	517	66,282	pCi/g
K-40	145	17,528	pCi/g
Na-22	207	25,040	pCi/g
Ni-63	46,500	5,634,000	pCi/g
Pu-238	5	5,008	pCi/g
Pu-239/240	4	3,756	pCi/g
Ra-226	0.03	6,260	pCi/g
Sr-90	129	15,650	pCi/g
Tc-99	26	3,314	pCi/g
Th-228	0.1	50,080	pCi/g
Th-232	0.01	6,260	pCi/g
U-234	5	626	pCi/g
U-235	6	751	pCi/g
U-238	6	751	pCi/g
Antimony	0.002	5	ug/g
Arsenic	0.01	94	ug/g
Barium	258	15,650	ug/g
Cadmium	1	94	ug/g
Chromium	0.03	12,520	ug/g
Lead	8	282	ug/g
Manganese	13	1,565	ug/g
Mercury	0.3	38	ug/g
Zinc	775	93,900	ug/g
Aroclor 1260	1	166	ug/g
Benzo(a)pyrene	6	689	ug/g
Chrysene	0.01	25	ug/g
Pentachlorophenol	0.3	33	ug/g

ug/g = mg/kg

Revised Summers Model Calculations
February 21, 1995

Objective

Estimate the concentrations of constituents in vadose zone which will elevate groundwater concentrations above allowable levels. The following presents revisions to the original April 1994 model, which is presented in the FFS.

Method

Allowable constituent concentrations are calculated using the Summers Model, which is rearranged to solve for concentration in soil from concentration in groundwater. The rearranged model is presented below:

$$C_p = \frac{C_{gw}(Q_p + Q_{gw}) - Q_{gw}C_i}{Q_p}$$

where

C_{gw}	=	Allowable concentration in groundwater (pCi/L or ug/L)
Q_p	=	Volumetric flow rate to groundwater (ft³/day); calculated as A_p x q
A_p	=	Horizontal area of contamination (ft²)
q	=	Recharge rate (ft/day)
Q_{gw}	=	Groundwater flow rate (ft³/day); calculated as V x h x w
V	=	Darcy velocity in groundwater (ft/day); calculated as K x i
K	=	Hydraulic conductivity of aquifer (ft/day)
i	=	Hydraulic gradient in aquifer (ft/ft)
h	=	Thickness of zone of mixing in aquifer (ft)
w	=	Width of zone of mixing in aquifer (site width) (ft)
C_i	=	Initial concentration in groundwater (assumed to be zero) (pCi/L or mg/L)

Concentration in soil is calculated from C_p (leachate concentration) as follows:

$$C_s = K_d C_p$$

where

C_s	=	Concentration in soil (pCi/g or ug/g)
C_p	=	Concentration in leachate (pCi/mL or ug/mL)
K_d	=	Distribution coefficient (mL/g)

For contaminants where the K_d value is zero, concentrations in soil are calculated as follows:

$$C_s = C_p\left(\frac{m}{d}\right)$$

where

m	=	volumetric moisture content (unitless)
d	=	dry soil density (g/mL)

Distribution coefficients for radionuclides and inorganics are estimated from a review of the literature (attached). Distribution coefficients for organics are estimated as follows:

$$K_d = K_{oc} f_{oc}$$

where

K_{oc}	=	Soil organic carbon constant (mL/g)
f_{oc}	=	Fraction of organic carbon in soil

K_{oc} values were unchanged from the FFS. The value for f_{oc} was assumed to be 0.1 percent (f_{oc} = 0.001), which was unchanged from the FFS.

Parameters

Parameter	Symbol	Value	Source
Allowable concentration in groundwater	C_{gw}	Contaminant specific	Maximum Contaminant Limits (MCLs) for nonradioactive contaminants; Derived Concentration Guides (DCG) for radionuclides
Volumetric flow to groundwater	Q_p	11.5 ft^3/day	A_p x q; A_p = 640,000 ft^2 (see below), q = 1.8 x 10^{-5} ft/day (see below)
Horizontal area of contamination	A_p	640,000 ft^2	Assumed surface area of 116-C-5 retention basin, based on dimensions of 800 ft x 800 ft
Recharge rate	q	1.8 x 10^{-5} ft/day	Varies from site to site. Assumed value of 0.2 cm/yr (Routson and Johnson, 1990)
Groundwater flow rate	Q_{gw}	7,200 ft^3/day	V x h x w; V = 0.3 ft/day (see below); h = 30 ft (see below); w = 800 ft (see below)
Darcy velocity in groundwater	V	0.3 ft/day	K x i; K = 100 ft/day (see below); i = 0.003 ft/ft (see below)
Hydraulic conductivity of the aquifer	K	100 ft/day	Hydraulic conductivity of the Ringold Formation (DOE-RL, 1993)

Parameter	Symbol	Value	Source
Hydraulic gradient of the aquifer	i	0.003 ft/ft	DOE-RL, 1993
Thickness of the mixing zone in the aquifer	h	30 ft	N Area Report
Width of the mixing zone	w	800 ft	Assumed to be the site width (value for 116-C-5 retention basin)
Volumetric moisture content	m	0.09	Soil moistures average 5 percent (w/w), or 9 percent by volume (DOE-RL, 1994)
Dry soil density	d	1.7 g/mL	Based on value of ~110 lbs/ft^3

References

DOE-RL. 1993. *Limited Field Investigation Report for the 100-BC-5 Operable Unit.* DOE-RL 93-37, Draft A.

DOE-RL. 1994. *100 Area Excavation Treatability Study Report.* DOE-RL 94-16. Decisional Draft.

EPA. 1986. Superfund Public Health Evaluation Manual.

Routson, R.C. and V.G. Johnson. 1990. Recharge estimations for the Hanford Site 200 Areas Plateau. *Northwest Science.* 64(3): 150-158.

Distribution Coefficients for Inorganic Contaminants in Soil

The distribution coefficient (K_d) is an empirical parameter that represents the tendency for a chemical substance to adsorb to soil. Typically, it is measured in the laboratory as the ratio of concentration in soil (C_s) to concentration in water (C_w), at equilibrium, as shown below:

$$K_d = \frac{C_s}{C_w}$$

The greater the extent of adsorption in soil, the greater the value of K_d.

Values for K_d can then be used in models to quantify the amount of contaminant in soil that can leach to groundwater. K_d values measured for an individual substance can vary substantially based on differences in soil properties. For example, the range of K_d values for plutonium and zinc measured in different soils can span four orders of magnitude (Dragun, 1988; Baes and Sharp, 1983). The variables affecting K_d include the relative abundance of different cations and anions in soil, soil pH, redox potential, cation exchange capacity and organic matter content (Dragun, 1988; Barney, 1978).

Ideally, the K_d value to be used to model leaching potential in Hanford soils should be based on site-specific measurements. However, sole reliance on site-specific measurements generally is not feasible. An alternate approach to developing K_d values for modeling is: 1) identify the range of K_d values measured in Hanford soils, or under conditions similar to those encountered in Hanford soils, and 2) select a value that provides a conservatively reasonable estimate of contaminant leaching to groundwater. These selected values then can be used for developing preliminary remediation goals (PRG) in soil.

Methodology

Several studies have compiled K_d values for a variety of soil, sediment and leachate conditions at the Hanford site. As discussed previously, these values generally span a range depending upon soil and leachate (liquid waste stream) conditions. These conditions including varying combinations in soils and leachate of:

- High or low salt concentrations
- High or low organic matter concentrations
- Acid (low pH) or neutral/basic (moderate to high pH) conditions

The approach for selecting conservatively reasonable values for K_d involved evaluating the characteristics of Hanford site soils, and identifying the K_d value corresponding most closely to those characteristics. The hierarchy of data used in selecting K_d values was to use Hanford-specific data in preference to more general compilations of K_d values in the literature. The selected values were compared with the range of general literature values. Finally, uncertainties in the data were discussed to support the selected K_d value.

Hanford Soil Characteristics

For purposes of selecting K_d values from the literature, most Hanford soils are characterized as low salt, low organic matter content with neutral to basic pH (Serne and Wood, 1990). Hanford soils typically are sandy with very little organic carbon content (Ames and Serne, 1991). Soil pH measured in 100 Area soils range from 6.5 to 7.66. Total organic carbon concentrations range from 600 to 1,640 ppm (DOE-RL, 1994).

K_d Data Sources

The principal sources of information on Hanford-specific K_d values consulted in this analysis were Ames and Serne, 1991 and Serne and Wood, 1990. These references provided information on most of the radionuclide and nonradioactive inorganic contaminants in soil in the 100 Area. Ames and Serne, 1991 provided ranges of K_d values for different waste stream characteristics (high/low dissolved solids; high/low organic content; low/neutral to high pH); these parameters being more variable than soil characteristics at the Hanford site. Ames and Serne also recommended conservative estimates of K_d values for use in modeling contaminant leaching (WHC, 1990). Ames and Serne, 1991 recommended K_d values for all of the contaminants of potential concern, except for C, As, Sb, Th and Ra. Serne and Wood, 1990 summarized available information on K_d values, and identified changes in K_d values with changing conditions in soil. These references did not reveal information on K_d values for thorium and arsenic. Information on these two contaminants in soil was developed from the range of K_d values compiled by Baes and Sharp, 1983. Baes and Sharp presented ranges of K_d values for 222 agricultural soils and clays between pH 4.5 and 9. The K_d values presented in these sources are summarized in Table 1.

Selected K_d Values

The K_d values selected for modeling contaminant concentrations leaching to groundwater are summarized in Table 1. Uncertainties in the data for selected contaminants are discussed below.

Cesium. Ames and Serne, 1991 recommended a K_d of 50 from values ranging from 50 to 3,000. Baes and Sharp, 1983 cite a range from 10 to 52,000, with a geometric mean of 1,100. According to Serne and Wood, 1990, the available data indicate that a minimum value of 200 is reasonable for ambient conditions in soil at the Hanford site (near neutral pH, low dissolved solids concentrations and low organic matter content); the value of 200 was selected as a K_d for cesium based on data evaluated by Serne and Wood, 1990.

Plutonium. Ames and Serne, 1991 recommended a K_d of 25, with a range from 100 to 2,000. Baes and Sharp, 1983 cite a range from 11 to 300,000, with a geometric mean of 1,800. Serne and Wood, 1990 cite studies in which plutonium sorption in a pH range from 4 to 8.5 was high, with K_d > 1,980. Based on the available data, Serne and Wood, 1990 recommended a range of K_d values from ~100 to 1,000 for ambient soil conditions at the Hanford site. Data reviewed by Serne and Wood, 1990 appear to show similarities in the behavior of plutonium and americium in soil, while Ames and Serne, 1991 recommend a K_d of 200 for americium. Based on this range of information, a K_d of 200 was selected for plutonium.

Uranium. Ames and Serne, 1991 recommend a K_d of 2 for uranium from a range from 2 to 2,000. Baes and Sharp, 1983 cite a range from 10.5 to 4,400, with a geometric mean of 45. Serne and Wood, 1990 suggest that uranium would sorb poorly to soil under neutral and basic conditions, and concluded that additional data were required to support a recommended K_d value. Uranium has been detected in groundwater at 100 Area sites, suggesting that it has some mobility in soil. While it is likely that K_d values are higher, a K_d of 2 was selected for modeling contaminant leaching.

Thorium. There have been no estimates of K_d developed for thorium at the Hanford site. The range of literature values cited by Baes and Sharp, 1983 is from 2,000 to 510,000. Values for K_d at a pH of 8.15 in medium sands (40-130) and very fine sands (310-470) (Yu et al., 1993) are likely to be appropriate for soil conditions at Hanford. The higher K_d values appear to be associated more with silty-clay soils (Ames and Rai, 1978). K_d values for thorium are lower with low soil pH. A conservative estimate of 100 was selected as a K_d for thorium in Hanford soils.

Radium. There have been no estimates of K_d developed for radium at the Hanford site, and there were no data cited in Baes and Sharp, 1983. Yu et al., 1993 compiled data indicating K_d values at acidic pHs (2 - 6) ranging from 0 to 60, and K_d values at neutral/basic pHs (7 - 7.7) ranging from 100 to 2,400. Data summarized in Ames and Rai, 1978 indicate K_d values at neutral/basic pHs ranging from 214 to 354. A conservative estimate of 200 was selected as a K_d for radium in Hanford soils.

Arsenic. There have been no estimates of K_d developed for arsenic at the Hanford site. The range of values cited in the literature are 1 to 8.3 for As III (geometric mean of 3.3) and 1.9 to 18 for As V (geometric mean of 6.7) (Baes and Sharp, 1983). A value of 3 was selected as a K_d for arsenic in Hanford soils.

Antimony. Estimates of K_d for antimony at the Hanford site range from 0 to 40 (Ames and Serne, 1991). Studies of the soil chemistry, and observed mobility of antimony-containing wastes have resulted in K_d values ranging from <1 to >1,000 (Ames and Rai, 1978). A value of 1 was selected as a K_d for antimony in Hanford soils.

Chromium. The mobility of chromium in soil will vary greatly with valence. Cr VI is highly mobile in soil, and has been estimated to have a K_d of zero (Ames and Serne, 1991). However, Cr VI is readily reduced in soil to Cr III by the presence of ferrous ion and organic matter. A minor amount of Cr III can be oxidized to Cr VI through the presence of manganese oxides in soils and sediments (Thorton et al., 1994). A suggested K_d value for Cr III = 200 mL/g.

9513337.1740

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Table 1. Summary of Revised Kd Values for Summers Model used in the 100 Area FFS

Contaminants of Potential Concern	Kds in the FFS	Revised Kd value	Source for Revised Kd value	Ames and Serne, 1991 (a)		Baes and Sharp, 1983 (c)	
				Recommended Value	Range	Geometric mean	Observed Range
Am-241	200	200	Ames and Serne, 1991	200	100-500	810	1.0-47,230
C-14	0.05	0	Serne and Woods, 1990				
Cs-134	50	50	Ames and Serne, 1991	50	50-3,000	1,110	10-52,000
Cs-137	50	50	Ames and Serne, 1991	50	50-3,000	1,110	10-52,000
Co-60	50	50	Ames and Serne, 1991	50	10-3,000	55	0.2-3,800
Eu-152	200	200	Ames and Serne, 1991	200	100-500		
Eu-154	200	200	Ames and Serne, 1991	200	100-500		
Eu-155	200	200	Ames and Serne, 1991	200	100-500		
H-3	0.05	0	Serne and Woods, 1990				
K-40	4	4	Ames and Serne, 1991			5.5	2.0-9.0
Na-22	4	4	Ames and Serne, 1991	4	1-30		
Ni-63	30	30	Ames and Serne, 1991	4	1-30		
Pu-238	25	200	Serne and Woods, 1990	25	100-2,000	1,800	11-300,000
Pu-239/240	25	200	Serne and Woods, 1990	25	100-2,000	1,800	11-300,000
Ra-226	0.05	100	Ames and Rai, 1978				
Sr-90	25	25	Ames and Serne, 1991	25	20-200	27	0.15-3,300
Tc-99	0.05	0	Serne and Woods, 1990	0	0		
Th-228	0.05	200	Ames and Rai, 1978			60,000	2,000-510,000
Th-232	0.05	200	Ames and Rai, 1978			60,000	2,000-510,000
U-233/234	2	2	Serne and Woods, 1990	2	2-2,000	45	10.5-4,400
U-235	2	2	Serne and Woods, 1990	2	2-2,000	45	10.5-4,400
U-238	2	2	Serne and Woods, 1990	2	2-2,000	45	10.5-4,400
Antimony	0.05	1	Ames and Rai, 1978	0	0-40		
Arsenic	0.05	3	Baes and Sharp, 1983			3.3 (As III); 6.7 (As V)	1.0-8.3 (As III); 1.9-18 (As V)
Barium	25	25	Ames and Serne, 1991	25	20-200		
Cadmium	30	30	Ames and Serne, 1991	30	100-200	6.7	1.26-26.8
Chromium	0.05	200	Ames and Serne, 1991; Thorton et al., 1994	0 (Cr VI)	0 (Cr VI) (b)	37	1.2-1,800
Lead	30	30	Ames and Serne, 1991	30	100-200	99	4.5-7,640
Manganese	50	50	Ames and Serne, 1991	50	10-3,000	150	0.2-10,000
Mercury	30	30	Ames and Serne, 1991	30	100-200		
Zinc	30	30	Ames and Serne, 1991	30	100-200	16	0.1-8,000
Aroclor 1260 (PCB)	530	530	EPA, 1986				
Benzo(a)pyrene	5500	5500	EPA, 1986				
Chrysene	200	200	EPA, 1986				
Pentachlorophenol	53	53	EPA, 1986				

(a) Recommended conservative value for liquid waste streams with low dissolved solids concentrations (<0.01 M), low organic concentration (<2 ppm), and pH>6).
(b) Recommended conservative Kd for Cr(III) was 200, with a range from 100-500
(c) Values for most elements are geometric means of population of values in agricultural soils and clays of pH 4.5 to 9.

SUMMERS MODEL PARAMETERS								
Parameter Description	Type	Units	Symbol	Value				
Allowable Concentration in Groundwater	Input - see Sheet 1	pCi/L or ug/L	C_gw					
Volumetric Flow to Groundwater	Calculated - do not input	ft^3/day	Q_p	575.270557		Calculation of Volumetric Flow to Groundwater (A_p * q)	Site Area (A_p) ft^2	640000
Groundwater Flow Rate	Calculated - do not input	ft^3/day	Q_gw	7200			Recharge rate (q) - ft/day	8.99E-04
Distribution Coefficient	Input - see Sheet 1	mL/g	K_d					
Volumetric moisture content	Input		m	0.09		Calculation of Groundwater Flow Rate (K * i * h * w)	Hydraulic conductivity (K) ft/day	100
Dry soil density	Input		d	1.7			Hydraulic gradient (i) - ft/ft	0.003
							Mixing zone thickness (h) - ft	30
							Mixing zone width (w) - ft	800

Contaminant Data Summary						
	Groundwater Protection Standards			Distribution Coefficients (mL/g)		
	Value	Units	Source			
Am-241	30	pCi/L	DCG	200		
C-14	70000	pCi/L	DCG	0		
Cs-134	2000	pCi/L	DCG	50		
Cs-137	3000	pCi/L	DCG	50		
Co-60	5000	pCi/L	DCG	50		
Eu-152	20000	pCi/L	DCG	200		
Eu-154	20000	pCi/L	DCG	200		
Eu-155	100000	pCi/L	DCG	200		
H-3	2000000	pCi/L	DCG	0		
K-40	7000	pCi/L	DCG	4		
Na-22	10000	pCi/L	DCG	4		
Ni-63	300000	pCi/L	DCG	30		
Pu-238	40	pCi/L	DCG	200		
Pu-239/240	30	pCi/L	DCG	200		
Ra-226	100	pCi/L	DCG	100		
Sr-90	1000	pCi/L	DCG	25		
Tc-99	100000	pCi/L	DCG	0		
Th-228	400	pCi/L	DCG	200		
Th-232	50	pCi/L	DCG	200		
U-234	500	pCi/L	DCG	2		
U-235	600	pCi/L	DCG	2		
U-238	600	pCi/L	DCG	2		
Antimony	6	ug/L	MCL	1.4		
Arsenic	50	ug/L	MCL	3		
Barium	1000	ug/L	MCL	25		
Cadmium	5	ug/L	MCL	30		
Chromium	100	ug/L	MCL	200		
Lead	15	ug/L	MCL	30		
Manganese	50	ug/L	MCL	50		
Mercury	2	ug/L	MCL	30		
Zinc	5000	ug/L	MCL	30		
Aroclor 1260	0.5	ug/L	MCL	530		
Benzo(a)pyrene	0.2	ug/L	MCL	5500		
Chrysene	0.2	ug/L	MCL	200		
Pentachlorophenol	1	ug/L	MCL	53		

Contaminant	Leachate Concentration (C_p)	Units	Leachate Concentration (C_p)	Units	Soil Concentration (C_s)	Units
Am-241	4.05E+02	pCi/L	0.4054755	pCi/mL	81	pCi/g
C-14	9.46E+05	pCi/L	946.1095	pCi/mL	50	pCi/g
Cs-134	2.70E+04	pCi/L	27.0317	pCi/mL	1,352	pCi/g
Cs-137	4.05E+04	pCi/L	40.54755	pCi/mL	2,027	pCi/g
Co-60	6.76E+04	pCi/L	67.57925	pCi/mL	3,379	pCi/g
Eu-152	2.70E+05	pCi/L	270.317	pCi/mL	54,063	pCi/g
Eu-154	2.70E+05	pCi/L	270.317	pCi/mL	54,063	pCi/g
Eu-155	1.35E+06	pCi/L	1351.585	pCi/mL	270,317	pCi/g
H-3	2.70E+07	pCi/L	27031.7	pCi/mL	1,431	pCi/g
K-40	9.46E+04	pCi/L	94.61095	pCi/mL	378	pCi/g
Na-22	1.35E+05	pCi/L	135.1585	pCi/mL	541	pCi/g
Ni-63	4.05E+06	pCi/L	4054.755	pCi/mL	121,643	pCi/g
Pu-238	5.41E+02	pCi/L	0.540634	pCi/mL	108	pCi/g
Pu-239/240	4.05E+02	pCi/L	0.4054755	pCi/mL	81	pCi/g
Ra-226	1.35E+03	pCi/L	1.351585	pCi/mL	135	pCi/g
Sr-90	1.35E+04	pCi/L	13.51585	pCi/mL	338	pCi/g
Tc-99	1.35E+06	pCi/L	1351.585	pCi/mL	72	pCi/g
Th-228	5.41E+03	pCi/L	5.40634	pCi/mL	1,081	pCi/g
Th-232	6.76E+02	pCi/L	0.6757925	pCi/mL	135	pCi/g
U-234	6.76E+03	pCi/L	6.757925	pCi/mL	14	pCi/g
U-235	8.11E+03	pCi/L	8.10951	pCi/mL	16	pCi/g
U-238	8.11E+03	pCi/L	8.10951	pCi/mL	16	pCi/g
Antimony	8.11E+01	ug/L	0.0810951	ug/mL	0.11	ug/g
Arsenic	6.76E+02	ug/L	0.6757925	ug/mL	2	ug/g
Barium	1.35E+04	ug/L	13.51585	ug/mL	338	ug/g
Cadmium	6.76E+01	ug/L	0.06757925	ug/mL	2	ug/g
Chromium	1.35E+03	ug/L	1.351585	ug/mL	270	ug/g
Lead	2.03E+02	ug/L	0.20273775	ug/mL	6	ug/g
Manganese	6.76E+02	ug/L	0.6757925	ug/mL	34	ug/g
Mercury	2.70E+01	ug/L	0.0270317	ug/mL	1	ug/g
Zinc	6.76E+04	ug/L	67.57925	ug/mL	2,027	ug/g
Aroclor 1260	6.76E+00	ug/L	0.006757925	ug/mL	4	ug/g
Benzo(a)pyrene	2.70E+00	ug/L	0.00270317	ug/mL	15	ug/g
Chrysene	2.70E+00	ug/L	0.00270317	ug/mL	1	ug/g
Pentachlorophenol	1.35E+01	ug/L	0.01351585	ug/mL	1	ug/g

APPENDIX E

100-HR-1 OPERABLE UNIT
FOCUSED FEASIBILITY STUDY REPORT

ACRONYMS

ARAR	applicable or relevant and appropriate requirements
ARCL	allowable residual contamination levels
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC	contaminants of potential concern
EPA	U.S. Environmental Protection Agency
FFS	focused feasibility study
NEPA	National Environmental Policy Act
RCRA	*Resource Conservation and Recovery Act*

CONTENTS

CONTENTS (continued)

FIGURES

TABLES

1.0 INTRODUCTION

The objective of this operable unit-specific FFS is to provide decision makers with sufficient information to allow appropriate and timely selection of interim remedial measures for sites associated with the 100-HR-1 Operable Unit. As discussed in the main text, certain inherent assumptions are required in order to establish "appropriate and timely" interim remedial measures. The assumptions and qualifiers outlined in the main text have been followed in the work being performed in this appendix. The plug-in approach is utilized in this appendix and is based on the same land use and groundwater use scenario as utilized in the Process Document. The sensitivity analysis is then used as a basis to discuss changes to the detailed investigation due to other land use and/or groundwater use scenarios.

The Process Document and this operable unit-specific FFS are based on an exposure scenario that includes occasional use of the land and frequent use of the groundwater. The sensitivity analysis (Appendix D) has been developed to show the impacts of additional exposure scenarios. The interim remedial measure candidate waste sites are determined in the limited field investigation (DOE-RL 1993d). Site profiles are developed for each of these waste sites. The site profiles are used in the application of the plug-in approach. The waste site either plugs into the analysis of the alternatives for the group, or deviations from the developed group alternatives are described and documented. A summary of the FFS results for the 100-HR-1 interim remedial measure candidate waste sites is as follows:

- None of the waste sites require additional alternative development.
- Three of the waste sites directly plug into the waste site group alternative (132-H-1, 132-H-2, and 132-H-3). The site-specific detailed analysis is conducted referencing the waste site group analysis as appropriate. A waste site detailed analysis summary is presented in Table 5-1.
- A comparative analysis of remedial alternatives is presented for each waste site. A summary of the comparative analysis is presented in Table 6-4.

1.1 PURPOSE AND SCOPE

The scope of this document is limited to 100-HR-1 Operable Unit interim remedial measure candidate sites as determined in the limited field investigation. Impacted groundwater beneath the 100 H Area shall be addressed in the 100-HR-3 FFS report. In addition, low priority waste sites and potentially impacted river sediments near the 100 Area are not considered candidates for interim remedial measures; they are being addressed under the remedial field investigation/corrective measures study pathway of the *Hanford Past Practice Strategy* (DOE-RL 1991). The decision to limit the scope of the FFS is documented and justified in the work plan, limited field investigation, qualitative risk assessment, and the 100 Area feasibility study Phase I and II (DOE-RL 1993a).

This report presents:

- The 100-HR-1 Operable Unit individual waste site information (Section 2.0)
- The development of individual site profiles (Section 2.0)
- The identification of representative groups for individual waste sites and a comparison against the applicability criteria and identification of appropriate enhancements for the alternatives (Section 3.0)
- A discussion of the deviations and/or enhancements of an alternative and additional alternative development, as needed (Section 4.0).
- The detailed analyses for waste sites which deviate from the representative group alternatives (Section 5.0).
- The comparative analysis for all individual waste sites using the Process Document baseline scenario (Section 6.0).
- A discussion of the modifications to the baseline scenario due to the results of the sensitivity analysis (Section 7.0)
- A comparative analysis for all individual waste sites using the revised scenario as developed in the sensitivity analysis (Section 7.0), if applicable.

1.2 INCORPORATION OF NATIONAL ENVIRONMENTAL POLICY ACT VALUES

In accordance with DOE Order 5400.4 and Chapter 10 of the *Code of Federal Regulations* (CFR) Part 1021, the considerations (values) of the *National Environmental Policy Act of 1969* (NEPA) must be incorporated in the CERCLA process. The NEPA considerations are incorporated in the Process Document (Section 3.3).

The NEPA values, such as description of the affected environment (including meteorology, hydrology, geology, ecological resources, and land use), applicable laws and guidelines, short-term and long-term impacts on human health and the environment, and cost are included to a limited degree within a typical CERCLA feasibility study. Other NEPA values not normally addressed in CERCLA feasibility study, such as socio-economic impacts, cultural resources, and transportation impacts, have been evaluated in the Process Document.

The NEPA impacts that are specific to the 100-HR-1 Operable Unit are discussed in Section 2.2 and detailed analysis of alternatives are addressed in Section 5.0 of this document.

2.0 WASTE SITE INFORMATION

2.1 OPERABLE UNIT BACKGROUND

The 100-HR-1 Source Operable Unit is located immediately adjacent to the Columbia River in the northeast portion of the 100 H Area. The operable unit lies primarily within the northeast quadrant of Section 18 of Township 14N, Range 27E, and is located between latitude 46° 42′ 30″ and 46° 43′ 30″ north and longitude 119° 29′ 00″ and 119° 28′ 00″ west. Site maps locate it within north/south Hanford Site plant coordinates N94,000 and N99,000 and east/west plant coordinates W37,000 and W41,000 (Figure 2-1).

The 100-HR-1 Operable Unit is one of three operable units associated with the 100 H Area at the Hanford Site. Two of these units, 100-HR-1 and 100-HR-2, are composed of source units. The groundwater operable unit is designated 100-HR-3 and includes the entire 100 H Area, the 100 D/DR Area, and the area in between. The 100 D/DR Area is located approximately 3.5 km (2 mi) southwest of the 100 H Area. The 100-HR-1 Operable Unit is bordered on the west and south by the 100-HR-2 Source Operable Unit, which is the solid and buried waste operable unit for the 100 H Area. Designated as a reactor effluent waste source, the 100-HR-1 Operable Unit contains most of the sites in the 100 H Area that were involved in plutonium production, including the 100 H Reactor and its cooling system.

Because the preparation of the *100 Area Feasibility Study Phases 1 and 2* (DOE-RL 1993a), additional data have been collected that is relevant to the 100 Area in general and to the 100-HR-1 Operable Unit specifically. A limited field investigation and a qualitative risk assessment were performed for the 100-HR-1 Operable Unit. The results of the interim remedial measure candidacy evaluation are presented in Table 2-1. Although the outfall structures were sites in the limited field investigation, they have been recently designated for an expedited response action and are not further addressed in this FFS. The *100 Area River Effluent Pipelines Expedited Response Action Proposal* (DOE-RL 1994) indicates that the 100 Area outfall structures will be addressed concurrently with the river pipelines. Table 2-1 identifies one site on the interim remedial measure pathway (116-H-2 Effluent Disposal Trench) that has an insufficient conceptual model because of discrepancies noted between the Dorian and Richards data (1978) and the limited field investigation data for that site. For this reason, additional data collection was recommended to confirm past sampling activities. In addition, aggregate area studies were performed to evaluate cultural resources and area ecology.

A summary of site background and ecological analyses is presented in Section 3.0 of the main text of the Process Document. The cultural resources of 100-HR-1 are discussed below.

Cultural Resources. The Hanford Cultural Resources Laboratory conducted an archaeological survey during fiscal year 1991 for the 100 Area Reactor compounds on the Hanford Site (Chatters et al. 1992). A summary of Hanford Site cultural resources can be found in Cushing (1992). The following is an excerpt from Cushing (1992) on the 100 H Area.

> "This area is situated in what is probably the most culturally rich area on the Hanford Site, and, since construction of the dams elsewhere in the Columbia River system, the most archaeological rich area in the western Columbia Plateau. There are 10 recorded archaeological sites within 2 km (1.2 mi) of the area, including 45BN128 through 45BN141, and 45GR302 (a,b, and c) through 45GR305. These include two historic Wanapum cemeteries, six camps (one associated with a cemetery), and three housepit villages."

The conclusions drawn during the limited field investigation assessment are used solely to determine interim remedial measure candidacy for high-priority sites and solid waste burial grounds within the 100-HR-1 Operable Unit. While this FFS relies on the data presented in the limited field investigation/qualitative risk assessment, assessments, evaluations, and conclusions drawn by the FFS are based on the methodology described in the Process Document.

2.1.1 Site Descriptions

To aid in the identification of the appropriate waste site group, the original physical and functional characteristics of each interim remedial measure candidate site have been developed. These characteristics include site name, functional use, physical description, and data source as described below.

<u>Site Name</u> - The site name is the initial indicator of the appropriate group.

<u>Functional Use</u> - Functional use of the site as an important characteristic in determination of waste site grouping. For example, if it is known that a site was used for transport of liquid wastes, using Figure 1-4 of the Process Document, it is possible to eliminate many potential groups.

<u>Physical Description</u> - This element defines the physical characteristics of a site by identifying both size and structure. These characteristics are valuable for evaluating extent of contamination, as well as identifying media/material.

<u>Data Source</u> - Identifies source of data for each waste site.

Descriptions of each interim remedial measures candidate site are presented in Table 2-2.

2.1.2 Refined Contaminants of Potential Concern

In a manner similar to the method described in Section 2.6 of the Process Document, refined contaminants of potential concern (COPC) have been developed for each interim remedial measure candidate site. These refined COPC are developed by screening the COPC from the 100-HR-1 qualitative risk assessment against the preliminary remediation goals defined in Appendix A. Tables 2-3 and 2-4 present the evaluation of refined COPC for waste sites with site-specific data. Waste sites that do not have site-specific data use data from the group site profile for COPC and, therefore, no site-specific COPC evaluation table is presented.

The preliminary remediation goals are developed under an occasional land use scenario considering risk to human and ecological receptors, compliance with applicable or relevant and appropriate requirements (ARAR), protection of groundwater, local background concentrations, and levels of detection. Of the sources of preliminary remediation goals, the most stringent value is used for screening as long as the value is not below local background and is above contractional detection levels. Another important aspect of the preliminary remediation goals is that the appropriate value varies with depth. As stated in Section 2.2.2 of Appendix A, beyond the 1 m (3 ft) of soil, humans are not considered to be receptors. Burrowing animals and most native plant roots are receptors within the first 0 to 3 m (0 to 10 ft) (Zone 1). Protection of groundwater must be considered throughout the soil column (Zone 1 and 2).

The data sources used for the identification of refined COPC include:

- *Limited Field Investigation for the 100-HR-1 Operable Unit* (DOE-RL 1993d)
- *Radiological Characterization of the Retired 100 Areas* (Dorian and Richards, 1978).

These data sources are the same as used to perform the qualitative risk assessment and constitute the basic data set for the 100 Area source operable units. The study by Dorian and Richards (1978) was comprehensive regarding the number of sites investigated; however, only radiological data were taken, and sampling and analysis protocol was not equivalent to the current standards. The limited field investigation data considered only a few sites but collected data for radionuclides, inorganics, and organics. Sampling and analysis protocols for the limited field investigation data are based on standards presented in the associated work plan (DOE-RL 1992b).

The following steps were followed for the assemblage of data for the identification of the refined COPC:

- The vadose zone was broken down into ranges consistent with the zones accessible by receptors as presented in the Process Document (i.e., Zone 1 from 0 to 3 m [0 to 10 ft], and Zone 2 below 3 m [10 ft])
- Maximum concentrations from the limited field investigation and Dorian and Richards (historical data) (1978) for each interval were identified and the historical data was decayed to 1992 for consistency with the limited field investigation data.

- The highest concentration between the limited field investigation and historical data was recorded for each interval.

- The maximum concentrations were screened against the preliminary remediation goals (Tables 2-5).

- All constituents which exceed preliminary remediation goals are identified and those which exceed a preliminary remediation goal in any of the intervals are considered refined COPC for the waste site.

When reviewing the data used for the identification of refined COPC, the following should be considered:

- The tables report only maximum concentrations; therefore, it should be noted that the entire data sets as well as the appropriate qualifiers and sampling and analysis protocols are discussed in the data source reports mentioned above.

- Data reported at an interval break, such as 4.5 m (15 ft), was reported in the previous range, i.e. 3 to 4.5 m (10 to 15 ft).

- Data reported that overlaps ranges is recorded in both ranges. (i.e., data from 4.4 to 4.8 m [14.5 to 16 ft] is recorded in the 3 to 4.5 m [10 to 15 ft] and 4.5 to 6 m [15 to 20 ft] ranges)

- Nickel-63 reported in Dorian and Richards may have been analyzed using a surrogate; therefore, the concentrations reported may not be an accurate representation of the actual concentration at the waste site.

- Total-Uranium reported in Dorian and Richards has been recorded as uranium-238 because uranium-238 is the major risk contributor of the uranium isotopes in the qualitative risk assessment.

The screening process results in the identification of all refined COPC, which must be addressed by any remedial action at the given interim remedial measure candidate site. Tables 2-3 and 2-4 present COPC screening for those sites that have analytical data.

2.1.3 Waste Site Profiles

Based on the data from the 100-HR-1 Operable Unit limited field investigation (DOE-RL 1993d) and the refined COPC discussed in Section 2.1.2, a profile for each interim remediation goals candidate site was developed. The site profiles consist of waste site characteristics such as extent of contamination, contaminated media/material, maximum concentrations of the refined COPC, and a determination of exceedance of allowable soil concentrations under a reduced infiltration scenario. The profiles perform two functions. First, they contain the information for comparison to the group profiles and alternative criteria defined in the Process Document (Section 4.2); second, they aid in the development of a data base used for determining costs and durations of remedial activities (i.e., contaminated volume impacts, cost of disposal, and duration of excavation). The profile parameters are defined below, site-specific profiles are detailed in Table 2-6.

- Extent of Contamination - Extent of contamination consists of impacted volume, length, width, area, and thickness. The values for these parameters are based on volume estimates performed for each site (presented in Attachment 1 of this appendix). Volume, length, width, and area do not necessarily impact the determination of appropriate remedial alternatives; however, they are important considerations for developing costs and durations of remedial actions. Thickness of the contaminated lens impacts the implementability of in situ actions, such as vitrification, which has a limited vertical extent of influence.

- Contaminated Media/Material - Contaminated media and material located at the site are determined and described. Structural materials such as steel, concrete, and wooden timbers influence the applicability of remedial alternatives as well as equipment needed for actions such as removal. The presence of soils and sludges are necessary for implementation of treatment options such as soil washing. The presence of solid waste media impacts material handling considerations and may require remedial alternatives that vary from sites with contaminated soil.

- Refined COPC/Maximum Concentrations - Refined COPC for a site are determined as discussed in Section 2.1.2 of this appendix. The associated maximum concentration for each constituent is the highest concentration detected in any of the interim remedial measure candidate site data. Refined COPC may influence the applicability of remedial alternatives. For instance, the presence of radioactive contaminants may allow natural decay to be a consideration in determining appropriate remedial actions, while the presence of organic contaminants may require that enhancements, such as thermal desorption, be added to a treatment system. The presence of cesium-137 influences the effectiveness of treatment alternatives such as soil washing.

- Reduced Infiltration Concentration - The reduced infiltration concentration is a level considered protective of groundwater under a scenario where hydraulic infiltration is limited by the application of a surface barrier. The derivation of this concentration is documented in Appendix A. The maximum concentration detected is compared to the allowable reduced infiltration concentration. Exceedance of the reduced infiltration concentrations indicates that impact to groundwater will not be mitigated by containment alternatives such as a barrier.

The profiles for each interim remedial measures candidate site in the 100-HR-1 Operable Unit are presented in Table 2-6.

2.2 CULTURAL AND ECOLOGICAL RESOURCES

2.2.1 Cultural Resources

The 100-HR-1 Operable Unit is located in an area known to be rich in cultural resources. The historic Wanapum Indian village of Tacht, located 1 km (0.6 m) south of the 100-H reactor facility, was occupied into the early 1940s when the Wanapum agreed to move so that the U.S. government could pursue its agenda (Cushing 1994). Areas adjacent to the heavily disturbed central portions of the reactor complex were surface surveyed in the 1990s for evidence of archaeological sites and none were found. It is possible, however, that subsurface archaeological deposits exist within the 100-HR-1 Operable Unit; areas located within 400 m (1,300 ft) of the Columbia River are considered high potential areas for cultural resources (Chatters 1989). In addition, because discussions with Native American peoples with historical ties to the 100-H Area have yet to take place, other areas might be considered sacred or to be traditional cultural properties; such discussions are planned for 1995. Cultural resource risk assessments are being conducted as outlined in the Hanford Site risk assessment methodology document (DOE, in preparation). Assessment scores will be determined and presented in an action plan being prepared for 100-H by environmental restoration contractor cultural resource staff. These assessments will accelerate cultural resource reviews and clearances, required of all Hanford projects involving ground disturbing activities, as mandated in the Hanford Cultural Resource Management Plan (Chatters 1989).

The following waste sites in the 100-HR-1 Operable Unit have high cultural resource sensitivity, so any work done involving these sites should include cultural resource staff to incorporate cultural resource concerns into remedial action decision making.

- 116-H-1 Process Effluent Disposal Trench
- 116-H-7 Sludge Burial Trench
- Process Effluent Pipelines.

Incorporating cultural resource concerns early into the cleanup process will allow cultural resource staff to collect necessary data, enable discussions with appropriate Native American groups, and establish agreed-to cultural resource procedures to be followed at each waste site before ground disturbing activities begin. Such efforts will greatly reduce the potential that projects will be delayed or need to be modified because of cultural resource concerns.

2.2.2 Ecology

The plant communities near the 100 Area immediately adjacent to the Columbia River have been broadly described as riparian and cheatgrass communities away from the shoreline (Rogers and Rickard 1977). The shoreline adjacent to 100-H Area is steeply sloped with a narrow riparian zone dominated by reed canarygrass and bluegrass and several white mulberries and golden currants. The shoreline flattens out to the south of 100-H Area in the vicinity of H slough. Most of the vegetation in the 100-HR-1 area is gray rabbitbrush and cheatgrass. The roadways are lined with sand dropseed and Russian thistle.

The insects, reptiles, birds, mammals, and sensitive species found in the 100-H Area are the same as those common to the Hanford Site. Bald eagles reside at the Hanford Site along the Columbia from November to March. Bald eagles are designated as a threatened species by the state and federal governments. Two major roosting sights exist along the river between D and H reactors and there are some perching and foraging sites near H reactor. Specific guidance on issues dealing with bald eagles can be found in the Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington (Fitzner and Weiss 1994). The aquatic ecology of the 100 Area is also described in Chapter 5.0 and Section 3.1.5.2.2.

2.2.3 Other NEPA Values

The NEPA values discussion in the Process Document encompass impacts conclusively for the 100 Area Source Operable Units. Other NEPA values, such as socioeconomic, transportation, recreation and aesthetics impacts within the 100-HR-1 Operable Unit, are consistent with the Process Document (Section 3.3) discussion.

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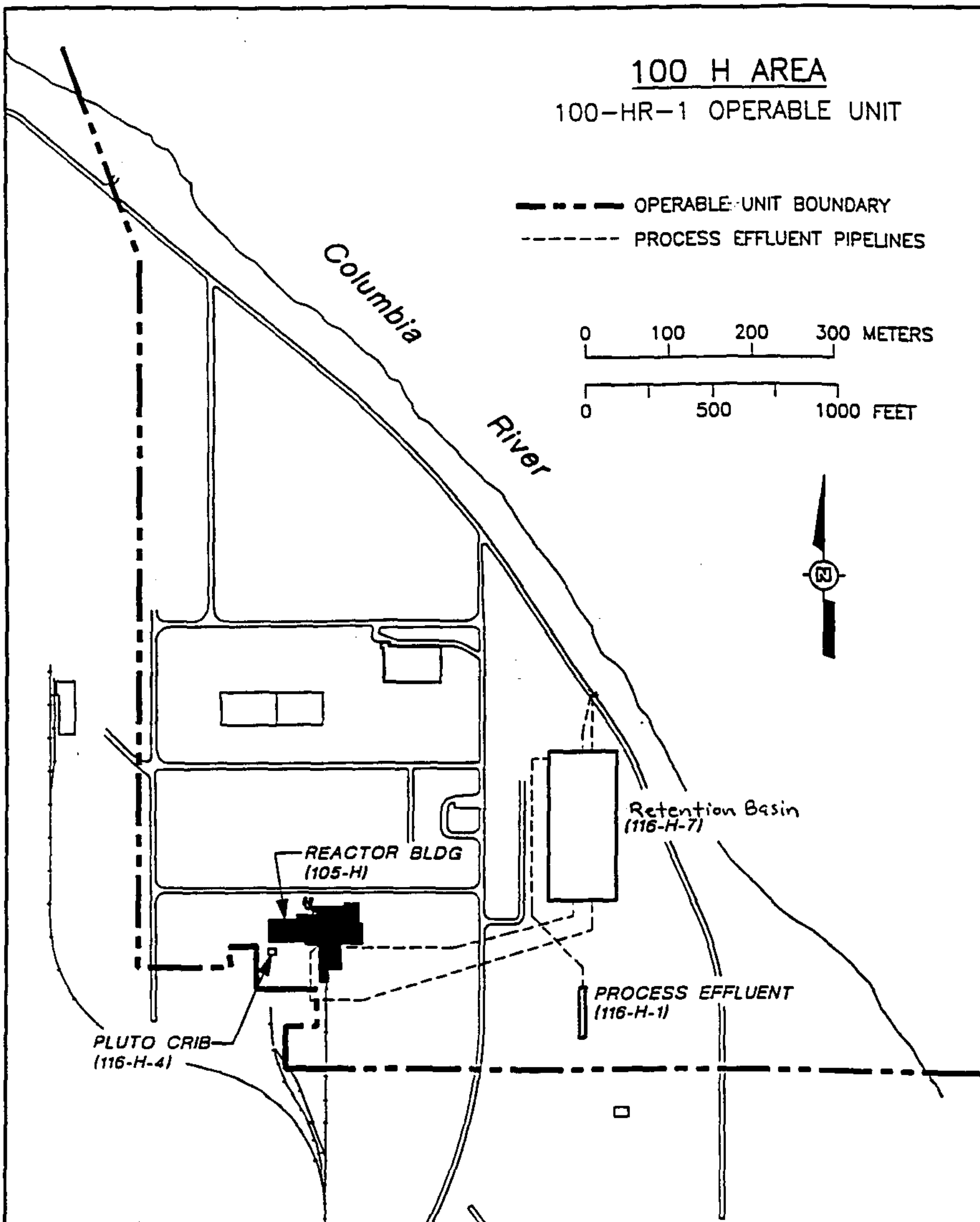
Figure 2-1. 100-HR-1 Operable Unit Map.

Figure 2-1 100-HR-1 Operable Unit Map



SOURCE: DOE/RL 94-63

ITH:JJA:P711B-A3

9513337.1752

Table 2-1. Interim Remedial Measures Recommendations from the 100-HR-1 Limited Field Investigation.

Waste Site	Qualitative Risk Assessment		Conceptual Model	Exceeds ARAR	Probable Current Impact on Groundwater	Potential for Natural Attenuation by 2018	IRM Candidate yes/no
	Low-frequency scenario	EHQ >1					
116-H-1 Process Effluent Disposal Trench	Medium	Yes	Adequate	Yes	Yes	No	Yes
116-H-2 Effluent Disposal Trench	Low	Yes	Incomplete(a)	No	No	No	Yes(b)
116-H-3 Dummy Decontamination French Drain	Low	No	Adequate	No	No	Yes	No
116-H-7 Process Effluent Retention Basin	High	Yes	Adequate	Yes	Yes	No	Yes
116-H-9 Confinement Seal Pit Drainage Crib	Low	No	Adequate	No	No	Yes	No
116-H-5 Process Effluent Outfall Structure	Medium	--	Adequate	No	No	No	Yes
Process Effluent Pipelines (Soil)	Very Low	No	Adequate	No	Yes	No	Yes
Process Effluent Pipelines (Sludge)	High	No	Adequate	No	Yes	No	Yes
116-H-7 Sludge Burial Trench	Very Low	--	Adequate	No	No	No	No
132-H-3 Effluent Pumping Station	Low	--	Adequate	Unknown	Unknown	Unknown	Yes
132-H-2 Exhaust Air Filter Building	Low	--	Adequate	Unknown	No	Unknown	Yes
132-H-1 Reactor Exhaust Stack	Low	--	Adequate	Unknown	No	Unknown	Yes
116-H-4 Pluto Crib	Low	--	Adequate	Unknown	No	Unknown	Yes

EHQ = Environmental Hazard Quotient (calculated by the qualitative ecological risk assessment [WHC, 1993]).
-- = not rated by the qualitative ecological risk assessment.
(a) = conceptual model is considered incomplete due to discrepancies between the limited field investigation (LFI) data and historical data. The LFI data indicates little or no contamination that contradicts with the historical data. Additional investigation may be necessary.
(b) = data needed concerning nature and vertical extent of contamination, site remains an interim remedial measure (IRM) candidate until data are available, therefore not evaluated on the same basin as other IRM sites in this focused feasibility study.
ARAR = applicable or relevant and appropriated requirements, specifically the Washington State Model Toxics Control Act Method B concentration values for soils (DOE-RL, 1992a).

Table 2-2. 100-HR-1 Interim Remedial Measure Waste Site Description.

Site Number/ Name (Alias)	Previous Use	Physical Description	Data Source
116-H-7/ (107-H Retention Basin)	Held cooling water effluent from H Reactor for short-term cooling/decay before release to Columbia River.	Retention Basin Reinforced concrete, single containment. 192.6 m x 84.1 m x 6.1 m deep	LFI, historical
116-H-1/ Process Effluent Disposal Trench (107-H Liquid Waste Disposal Trench)	Received high activity effluent produced by ruptured fuel elements. Received sludge from 116-H-7 retention basin when 100 H Area was deactivated. Also received 90 kg of sodium dichromate.	Trench Unlined 58.8 m x 33.5 m x 4.6 m deep	LFI, historical
116-H-4/ Pluto Crib (105-H Pluto Crib)	Received cooling water discharge contaminated by failed fuel elements. Received 1,000 kg of sodium dichromate. Crib was excavated and material buried in 118-H-5 burial ground. 132-H-2 exhaust air filter building was later built on the same site.	Crib/French Drain Unlined pluto crib. 3.1 m x 3.1 m x 3.1 m deep	No analytical data
Buried Pipelines	Transported reactor cooling water from reactors to retention basins, outfall structures, and 116-H-1 trench; leaked effluent to soil; contains contaminated sludge and scale.	Process Effluent Pipelines Total length $\approx$1228 m; pipe diameter varies; depth below surface varies.	historical
132-H-1/(116-H Reactor Exhaust Stack)	Contaminated stack demolished in place, buried, and covered with 1.5 m fill.	D&D Facility Demolished reinforced concrete exhaust stack. 67.1 m high x 7.6 m x 4.6 m deep	D&D
132-H-2/(117-H Exhaust Air Filter Building)	Contaminated building demolished in place, buried, and covered with 5 m fill. Building was built on site of the demolished and removed 116-H-4 pluto crib.	D&D Facility Demolished reinforced concrete building. 22.6 m x 12.5 m x 12.5 m x 8.8 m deep	D&D (Beckstrom 1984)
132-H-3/(1608-H Effluent Pumping Station)	Collected and pumped water from H Reactor drains, including irradiated fuel storage drains, into 116-H-7 process effluent retention basin. Water and sludge in sumps was removed before station was demolished in place and covered with 5 m of fill.	D&D Facility Four concrete sumps. Capacity of $\approx$300,000 liters 11 m x 10.4 m x 9.7 m deep	D&D (Cummings 1987)

D&D = decontamination and decommissioning
LFI = limited field investigation

Table 2-3. 116-H-7 Refined Contaminants of Potential Concern (Occasional-Use Scenario, Protection of Groundwater).

Table 2-3. 116-H-7 Retention Basin Refined Contaminants of Potential Concern based on Occasional Land Use Scenario and Protection of Groundwater

116-H-7	Zone 1 (a) 0 - 3 ft Max	Zone 1 (a) 0 - 3 ft Screening*	Zone 1 (a) 3 - 6 ft Max	Zone 1 (a) 3 - 6 ft Screening*	Zone 1 (a) 6 - 10 ft Max	Zone 1 (a) 6 - 10 ft Screening*	Zone 2 (b) 10 - 15 ft Max	Zone 2 (b) 10 - 15 ft Screening*	Zone 2 (b) 15 - 20 ft Max	Zone 2 (b) 15 - 20 ft Screening*	Zone 2 (b) 20 - 25 ft Max	Zone 2 (b) 20 - 25 ft Screening*	Zone 2 (b) 25 - 30 ft Max	Zone 2 (b) 25 - 30 ft Screening*	Zone 2 (b) 30 - 35 ft Max	Zone 2 (b) 30 - 35 ft Screening*	Refined COPC Summary
RADIONUCLIDES (pCi/g)																	
Am-241		NO		NO	7.20E-01	NO	7.20E-01	NO		NO		NO		NO		NO	
C-14		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134	5.52E+00	NO	4.10E-01	NO	3.68E-04	NO	6.44E-04	NO		NO		NO		NO		NO	
Cs-137	**4.29E+01**	**YES**	**2.01E+03**	**YES**	**4.64E+01**	**YES**	4.29E+01	NO	5.67E+01	NO	1.52E+01	NO	1.80E+01	NO	3.53E-01	NO	YES
Co-60	**3.42E+01**	**YES**	**2.20E+03**	**YES**	**3.60E+01**	**YES**	3.60E+01	NO	2.93E+01	NO	3.66E+01	NO	2.81E+00	NO		NO	YES
Eu-152	**4.86E+02**	**YES**	**1.72E+04**	**YES**	**2.60E+02**	**YES**	2.60E+02	NO	2.08E+02	NO	1.41E+02	NO	7.07E+00	NO	7.07E-02	NO	YES
Eu-154	**9.37E+01**	**YES**	**5.68E+03**	**YES**	**3.70E+01**	**YES**	3.70E+01	NO	3.69E+01	NO	3.12E+01	NO	1.25E+00	NO		NO	YES
Eu-155	8.88E+00	NO	6.63E+02	NO	8.13E-01	NO	1.18E+00	NO	2.57E+00	NO	2.03E+00	NO	1.28E-01	NO		NO	
H-3	7.70E+00	NO	1.50E+02	NO	6.89E+00	NO	1.78E-01	NO	1.74E+01	NO		NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63	1.07E+03	NO	1.79E+04	NO		NO		NO		NO		NO		NO		NO	
Pu-238	4.49E-01	NO	**6.78E+00**	**YES**	2.38E-02	NO	6.96E-02	NO	2.64E-01	NO		NO		NO		NO	YES
Pu-239/240	**1.40E+01**	**YES**	**2.00E+02**	**YES**	1.30E+00	NO	1.90E+00	NO	3.20E+00	NO	5.00E-02	NO		NO		NO	YES
Ra-226	2.90E-01	NO		NO		NO	6.50E-01	NO	6.50E-01	NO	4.40E-01	NO		NO		NO	
Sr-90	9.51E+01	NO	**2.38E+02**	**YES**	3.20E+00	NO	1.22E+01	NO	1.15E+02	NO	8.15E-01	NO	1.36E+00	NO	7.47E-01	NO	YES
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228	4.10E-01	NO		NO		NO	8.10E-01	NO	8.10E-01	NO	4.60E-01	NO		NO		NO	
Th-232	4.10E-01	NO		NO		NO		NO	4.40E-01	NO	4.40E-01	NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO	3.80E-01	NO	3.80E-01	NO		NO		NO		NO		NO	
U-238 (k)	8.30E-01	NO	4.70E+00	NO	6.80E-01	NO	6.80E-01	NO	5.30E-01	NO	5.30E-01	NO		NO		NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic	**4.70E+01**	**YES**		NO		NO		NO		NO		NO		NO		NO	YES
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO	
Lead	**5.40E+02**	**YES**		NO		NO		NO		NO		NO		NO		NO	YES
Manganese		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.

Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-76
DOE-RL, 1993d, Tables 3-2,4, 5

Table 2-4. 116-H-1 Refined Contaminants of Potential Concern (Occasional-Use Scenario, Protection of Groundwater).

Table 2-4. 116-H-1 Process Effluent Trenches Refined Contaminants of Potential of Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)										Refined
116-H-1	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																	
Am-241		NO		NO		NO	2.00E-01	NO	1.60E-01	NO		NO		NO		NO	
C-14		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134		NO	1.75E-04	NO		NO	1.56E-04	NO		NO	1.84E-04	NO		NO		NO	
Cs-137	**4.01E+02**	YES	9.00E-01	NO	**2.21E+01**	YES	3.20E+01	NO	3.60E+02	NO	3.88E+01	NO		NO		NO	YES
Co-60	**3.42E+01**	YES	8.30E-02	NO	9.64E-01	NO	2.50E+00	NO	5.37E+01	NO	7.44E+00	NO		NO		NO	YES
Eu-152	**5.30E+02**	YES	1.28E+00	NO	2.03E+00	NO	5.40E+01	NO	9.28E+02	NO	1.11E+02	NO		NO		NO	YES
Eu-154	**8.80E+01**	YES	1.42E-01	NO	4.83E-01	NO	5.40E+00	NO	7.10E+02	NO	1.85E+01	NO		NO		NO	YES
Eu-155	4.49E+00	NO	5.03E-02	NO	2.35E-02	NO	7.17E-02	NO	9.95E+00	NO	8.56E-01	NO		NO		NO	
H-3		NO		NO		NO	3.93E-01	NO	2.55E-01	NO		NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238	2.82E-01	NO		NO		NO		NO	3.08E-01	NO		NO		NO		NO	
Pu-239/240	**6.60E+00**	YES		NO		NO	7.40E-01	NO	**1.10E+01**	YES	1.80E+00	NO		NO		NO	YES
Ra-226		NO		NO		NO		NO	8.50E-01	NO	5.50E-01	NO		NO		NO	
Sr-90	3.53E+01	NO		NO		NO	1.22E+00	NO	5.57E+01	NO	1.09E+01	NO		NO		NO	
Tc-99		NO		NO		NO		NO	6.70E-01	NO		NO		NO		NO	
Th-228		NO		NO		NO	9.50E-01	NO	7.50E-01	NO	7.50E-01	NO		NO		NO	
Th-232		NO		NO		NO		NO	8.90E-01	NO	6.40E-01	NO		NO		NO	
U-233/234		NO		NO		NO	5.30E-01	NO	6.20E-01	NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO	6.10E-01	NO	3.91E-01	NO	5.80E-01	NO		NO		NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO	**3.79E+01**	YES	**2.76E+01**	YES		NO		NO		NO	YES
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO	**2.96E+01**	YES		NO		NO		NO	YES
Lead		NO		NO		NO	**1.87E+02**	YES	**1.45E+02**	YES		NO		NO		NO	YES
Manganese		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO	8.10E-01	NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO	**9.20E-01**	YES		NO		NO		NO	YES
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.

Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-76
DOE-RL, 1993d, Tables 3-2,4, 5

Table 2-5. Preliminary Remediation Goals.

	HUMAN-HSRAM (a,b)		PROTECTION of GROUNDWATER (a,c)	BACKGROUND (d,e)	CRQL/CRDL or as noted	(f)	ZONE SPECIFIC PRG 1 (g)	ZONE SPECIFIC PRG 2 (h)
	TR = 1E-06	HQ = 0.1					0-10 ft.	>10 ft.
RADIONUCLIDES (pCi/g)								
Am-241	76.9	N/A	31	N/C	1		31	31
C-14	44,200	N/A	18	N/C	50		50	50
Cs-134	3,460	N/A	517	N/C	0.1	(d)	517	517
Cs-137	5.68	N/A	775	1.8	0.1	(d)	6	775
Co-60	17.5	N/A	1,292	N/C	0.05	(d)	18	1,292
Eu-152	5.96	N/A	20,667	N/C	0.1		6	20,667
Eu-154	10.6	N/A	20,667	N/C	0.1	(d)	11	20,667
Eu-155	3,080	N/A	103,000	N/C	0.1	(d)	3,080	103,000
H-3	2,900,000	N/A	517	N/C	400		517	517
K-40	12.1	N/A	145	19.7	4	(d)	19.7	145
Na-22	545	N/A	207	N/C	4	(i)	207	207
Ni-63	184,000	N/A	46,500	N/C	30		46,500	46,500
Pu-238	87.9	N/A	5	N/C	1	(d)	5	5
Pu-239/240	72.8	N/A	4	0.035	1	(d)	4	4
Ra-226	1.1	N/A	0.03	0.98	0.1	(d)	1	1
Sr-90	1,930	N/A	129	0.36	1	(d)	129	129
Tc-99	28,900	N/A	26	N/C	15		26	26
Th-228	7,260	N/A	0.1	N/C	1	(j)	1	1
Th-232	162	N/A	0.01	N/C	1		1	1
U-233/234	165	N/A	5	1.1	1	(d)	5	5
U-235	23.6	N/A	6	N/C	1	(d)	6	6
U-238 (k)	58.4	N/A	6	1.04	1	(d)	6	6
INORGANICS (mg/kg)								
Antimony	N/A	167	0.002	N/C	6		6	6
Arsenic	16.2	125	0.013	9	1	(e)	9	9
Barium	N/A	29,200	258	175	20	(e)	258	258
Cadmium	1,360	417	0.775	N/C	0.5		0.8	0.775
Chromium VI	204	2,086	0.026	28	1	(e)	28	28
Lead	N/C	N/C	8	14.9	0.3	(e)	14.9	14.9
Manganese	N/A	2,086	13	583	1.5	(e)	583	583
Mercury	N/A	125	0.31	1.3	0.02	(e)	1.3	1.3
Zinc	N/A	100,000	775	79	2	(e)	775	775
ORGANICS (mg/kg)								
Aroclor 1260 (PCB)	4.34	N/A	1.37	<0.033	0.033	(e)	1	1
Benzo(a)pyrene	5	N/A	5.68	<0.330	0.330	(e)	5	6
Chrysene	N/A	N/A	0.01	<0.330	0.330	(e)	0.330	0.330
Pentachlorophenol	300	N/A	0.27	<0.8	0.8	(e)	0.8	0.8

TR=Target Risk; HQ= Hazard Quotient; N/A=Not Applicable; N/C=Not calculated

(a) Risk-based numbers are expressed to to one significant figure.

(b) Occasional Use Scenario

(c) Based on Summer's Model (EPA 1989b)

(d) Status Report, Hanford Site Background: Evaluation of Existing Soil Radionuclide Data (Letter #008106)

(e) Hanford Site Background: Part 1, Soil Background for Nonradioacitve Analytes, DOE/RL-92-24, Rev. 2.

(f) Based on 100-BC-5 OU Work Plan QAPP (DOE-RL 1992)

(g) PRGs are established to be protective of groundwater, human and ecological receptors. The screening process used to establish PRGs for zone 1 are discussed in section 2.3 of this document.

(h) PRGs are established to be protective of groundwater. The screening process used to establish PRGs for zone 2 are ciscussed in section 2.3 of this document.

(i) Based on gross beta analysis

(j) Detection limit assumed to be same as Th-232

(k) Includes total U if no other data exist

(l) Value calculated exceeds 1,000,000 ppm therefore use 100,000 ppm as default

9513337.1756

Table 2-6. 100-HR-1 Waste Site Profile.
(Page 1 of 2)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-H-7 (retention basin)	56483.0	201.8	93.3	18828.0	3.0	Soil Concrete	Radionuclides ^{60}Co ^{137}Cs ^{152}Eu ^{154}Eu ^{238}Pu $^{239/240}Pu$ ^{90}Sr Inorganics Arsenic Lead	pCi/g 2.20×10^3 2.01×10^3 1.72×10^4 5.68×10^3 6.78 2.00×10^2 2.38×10^2 mg/kg 4.7×10^1 5.40×10^2	 NO NO NO NO NO NO NO YES NO
116-H-1 (process effluent trench)	12,015.0	58.8	33.5	1970.0	6.1	Soil	Radionuclides ^{60}Co ^{137}Cs ^{152}Eu ^{154}Eu $^{239/240}Pu$ Inorganics Arsenic Chromium VI Lead Organics Chrysene	pCi/g 3.42×10^1 4.01×10^2 5.30×10^2 8.8×10^1 1.1×10^1 mg/kg 3.79×10^1 2.96×10^1 1.87×10^2 ppb 9.20×10^2	 NO NO NO NO NO YES YES NO NO
116-H-4 (pluto crib)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA

Table 2-6. 100-HR-1 Waste Site Profile.
(Page 2 of 2)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
100 H pipeline (Pipeline)	(b)	(b)	(b)	(b)	(b)	Steel Concrete	<u>Radionuclides</u> ^{60}Co ^{137}Cs ^{152}Eu ^{154}Eu ^{155}Eu ^{63}Ni ^{238}Pu $^{239/240}Pu$ ^{90}Sr	assume data from pipeline group	NO(c)
132-H-1 Reactor Exhaust Stack (D&D facility)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA
132-H-2 Filter Building (D&D facility)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA
132-H-3 Effluent Pumping Station (D&D facility)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA

(a) Where concentration exceeds preliminary remediation goals.
(b) = no contaminated soil is associated with the site, therefore no volume of contamination is calculated; extent of contamination is limited to the pipeline itself.
(c) Based on group data.
COPC = contaminants of potential concern
NA = not applicable
D&D = decontamination and decommissioning

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3.0 RESULTS OF THE PLUG-IN APPROACH

This section provides the "plug-in" (Section 1.4 of the Process Document) approach as applied to the interim remedial measures candidate sites in the 100-HR-1 Operable Unit. The plug-in approach requires identification of the waste site group to which a waste site belongs and an evaluation of the alternate applicable criteria.

Identification of the waste site group to which each waste site belongs is accomplished by using the waste site descriptions defined in Section 2.0 and fitting the site into the appropriate waste site group in Figure 1-4 of the Process Document. It is also necessary to refer to the group descriptions defined in Section 3.0 of the Process Document. The appropriate group for each site is identified in Table 3-1.

Table 3-1 presents the evaluation of the alternative applicability criteria for each interim remedial measures waste site. The evaluation represents step 6 of the plug-in approach (Section 1.4 of the Process Document) and identifies which alternatives and enhancements apply to each site. Any deviation from alternatives developed for the appropriate group in the Process Document are identified by footnote. Sites with deviations will be developed further in subsequent sections; however, the general analysis of alternatives in the Process Document (Section 5.0) will be used for sites without deviations.

The deviations indicated in Table 3-1 are briefly summarized as follows:

- Waste site 116-H-7 retention basin has contamination <5.8 m thick; therefore, in situ vitrification does apply.
- Waste site 116-H-1 process effluent trench has contamination which is >5.8 m thick; therefore, in situ vitrification does not apply. Also, because organic contaminants are present, thermal desorption will be added as an enhancement to the treatment alternative.
- Waste site 100-H buried pipelines are not known to have soil contamination associated with them; therefore, treatment is not applicable.
- Waste site 116-H-4 pluto crib was removed and buried in waste site 118-H-5 burial ground in the past; therefore, no action is warranted at the site.

3.1 EXAMPLE APPLICATION OF THE PLUG-IN APPROACH (116-H-7)

In order to achieve a further understanding of the plug-in approach (Section 1.4 of the Process Document), an example of its application has been developed. The example, waste site 116-H-7, will be evaluated as dictated by the plug-in approach. The waste site profile has been defined in Section 2.0 (completing step 4 of the approach). Steps 5 and 6 of the approach are completed below.

3.1.1 Identification of Appropriate Group

Waste site 116-H-7 retention basin is assessed against the elements of Figure 1-4 of the Process Document to ensure that the appropriate group is identified.

Table 2-2 does not indicate that the site received solid waste, and states that the site held cooling water effluent from H Reactor for short-term cooling/decay before release to the Columbia River. This indicates that it is a contaminated soil site used for liquid effluent transfer. Table 2-2 does indicate that the site is a reinforced concrete retention basin. It can be concluded that the appropriate group for waste site 116-H-7 is the retention basins. The profile for the group and the associated detailed and comparative analyses are documented in the Process Document.

3.1.2 Evaluation of the Alternative Applicability Criteria

Based on the description and profile developed for waste site 116-H-7 in Section 2.0, an evaluation of the alternative applicability criteria can be accomplished. The evaluation of each alternative is presented below.

<u>No Action</u> - There is data indicating that there is contamination present at the site which warrants an interim action. Therefore, no action is not an appropriate alternative.

<u>Institutional Controls</u> - Refined COPC are identified for waste site 116-H-7 in Table 2-3 indicating that there are contaminants present which exceed preliminary remediation goals. Therefore, institutional controls will not effectively address contaminants at the site.

<u>Containment</u> - Because there are contaminants which exceed reduced infiltration concentrations at waste site 116-H-7, containment will not be applicable at the site.

<u>Removal/Disposal</u> - Because contaminants exceed preliminary remediation goals, this alternative may be applicable.

<u>In Situ Treatment</u> - Because contaminants exceed preliminary remediation goals, and the contaminated lens is <5.8 m (19 ft), the in situ treatment option may be applicable.

<u>Removal/Treatment/Disposal</u> - Because contaminants exceed preliminary remediation goals, this alternative may be applicable. Thermal desorption enhancement is not necessary because organic contaminants are not present at the site. For cost purposes, it was assumed that the percentage of contaminated soil that can be effectively treated by soil washing is 33% of the 116-H-7 waste site. This percentage was based on the depth, distribution, and concentration of contaminants at the waste site. This does not affect the application of the alternative but does impact the magnitude of volume reduction realized at the site.

This evaluation resulted in identifying applicable alternatives. These results are compared to the results of the group analysis presented in Table 5-1 of the Process Document to identify deviations.

	116-H-7 Alternatives	Group Alternatives
Applicable	Removal/Disposal In Situ Treatment Removal/Treatment/Disposal - no enhancements	Removal/Disposal Removal/Treatment/Disposal - no enhancements
Not Applicable	No Action Institutional Controls Containment	No Action Institutional Controls Containment In Situ Treatment

The alternatives for waste site 116-H-7 are not the same as those for the retention basin group; therefore, deviations are identified and the site does not completely plug into the analyses for the group. The deviation is with respect to the in situ treatment alternative. Contrary to the retention basin group, waste site 116-H-7 has a lens of contamination that is <5.8 m (19 ft); therefore, in situ vitrification may be applicable at the site.

Table 3-1. Comparison of Waste Sites to Remedial Alternatives. (page 1 of 2)

Waste Site	Group	116-H-7 Retention Basin	116-H-1 Process Effluent Trench	PIPELINES Buried Pipeline	116-H-4 Pluto Crib	132-H-1 132-H-2 132-H-3 Decontamination and Decommissioning
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**				
No Action						
SS-1 SW-2	Criterion: • Has site been effectively addressed in the past?	No	No	No	Yes (d)	Yes
Institutional Controls						
SS-2 SW-2	Criterion: • Contaminants < PRG	No	No	No	NA	NA
Containment						
SS-3 SW-3	Criteria: • Contaminants > PRG	Yes	Yes	Yes	NA	NA
	• Contaminants < reduced infiltration concentrations	No	No	Yes	NA	NA
Removal/Disposal						
SS-4 SW-4	Criterion: • Contaminants > PRG	Yes	Yes	Yes	NA	NA
In Situ Treatment						
SS-8A	Criteria: • Contaminants > PRG	Yes	Yes	NA	NA	NA
	• Contamination < 5.8 m in depth	Yes(d)	No(d)	NA	NA	NA
SS-8B	Criteria: • Contaminants > PRG	NA	NA	Yes	NA	NA
	• Contaminants < reduced infiltration concentrations	NA	NA	Yes	NA	NA
SW-7	Criteria: • Contaminants > PRG	NA	NA	NA	NA	NA
	• Contaminants < reduced infiltration concentrations	NA	NA	NA	NA	NA

Table 3-1. Comparison of Waste Sites to Remedial Alternatives. (page 2 of 2)

Waste Site Group		116-H-7 Retention Basin	116-H-1 Process Effluent Trench	PIPELINES Buried Pipeline	116-H-4 Pluto Crib	132-H-1 132-H-2 132-H-3 Decontamination and Decommissioning
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**				
Removal/Treatment/Disposal						
SS-10	Criterion: • Contaminants > PRG	Yes	Yes	NA(d)	NA	NA
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system)	No	Yes(d)	NA(d)	NA	NA
	• Percentage of contaminated volume less than twice the PRG for cesium-137.	33%	33%	NA(d)	NA	NA
SW-9	Criterion: • Contaminants > PRG	NA	NA	NA	NA	NA
	Enhancement: • Organic contaminants	NA	NA	NA	NA	NA

NA - not applicable
(d) - deviation from waste site group
PRG - preliminary remediation goals

4.0 ALTERNATIVE DEVELOPMENT

This section describes the alternative enhancement and site-specific alternative development for waste sites that do not align with the Process Document group profiles.

Alternatives do not require further development if the site plugs directly into the group profiles (Process Document, Section 1.4, step 6a). The waste sites that meet this requirement are 132-H-1, 132-H-2, and 132-H-3.

The sites that do not plug in directly (Process Document, Section 1.4, step 6b) can be divided into two groups. The first group contains those sites that require enhancements to an alternative or an inclusion or dismissal of an alternative as originally proposed. These sites are discussed in the bullets that follow. However, the enhancements do not need development for these sites, because the Process Document incorporates the appropriate enhancements in Section 1.4.

- The 116-H-4 pluto crib does not meet the applicability criteria for the pluto crib group alternatives identified in the Process Document. Because this site was excavated and material buried in waste site 118-H-5 (decontamination and decommissioning), contamination is believed to no longer exist at the site. Therefore, this site meets the applicability criteria for the no action alternative. Accordingly, this site deviates from the group because of a change in the applicable alternatives.

- The 116-H-1 process effluent trench requires thermal desorption as an enhancement option (due to the presence of organic contamination) to the removal/treatment/disposal alternative. Additional development of the technology and alternative are not required because the Process Document discusses thermal desorption as a treatment enhancement. Waste site 116-H-1 does not meet the applicability criteria for in situ vitrification (unlike the process effluent trench group).

- The 116-H-7 retention basin does meet the applicability criteria for the in situ treatment alternative because of its relatively shallow depth of contamination. Therefore, this site deviates from the retention basin group. However, this deviation does not require additional development of technologies or alternatives.

- Buried pipelines in the 100-HR-1 Operable Unit have no identified contaminated soils associated with them; therefore, the removal/treatment/disposal alternative does not apply. This is a deviation from the group; therefore, this site does not require additional development of technologies or alternatives.

The second group of sites, which do not plug in, are those sites that require a significant modification to an alternative such as changes in the excavation process or disposal options. Alternatives for sites included in this second set will require additional development. None of the sites within the 100-HR-1 Operable Unit fit into this second set; therefore, additional alternative development is not required.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analysis of the alternatives applicable to the individual waste sites within the 100-HR-1 Operable Unit. In the detailed analysis, each alternative is assessed against the evaluation criteria described in Section 5.1 of the Process Document. The purpose of the detailed analysis is to provide a basis for the comparison of the alternatives and support a subsequent evaluation of the alternatives made by the decision makers in the remedy selection process.

The detailed analysis for the sites within the 100-HR-1 Operable Unit are presented in the following manner:

- The detailed analyses for those individual waste sites that do not deviate from the waste site groups are referenced to the group discussion presented in the Process Document.

- The detailed analyses for those individual waste sites that deviate from the waste site groups are discussed in Section 5.2.

5.1 SITE-SPECIFIC COMMON EVALUATION CONSIDERATIONS

Based on the comparison presented in Table 3-1, several of the individual waste sites within the 100-HR-1 Operable Unit plug into the waste site group alternatives; therefore, the common evaluation considerations for these individual waste sites can be found in the Process Document. These individual waste sites include 132-H-1, 132-H-2, and 132-H-3.

The common evaluation considerations for the remaining waste sites (116-H-7, 116-H-1, 116-H-4, and 100-H pipelines) are discussed in the following sections. Each deviation of a Process Document alternative for these waste sites is analyzed for impacts to transportation, air quality, ecological, cultural, socioeconomic, noise and visual resources. In addition to identifying those potential impacts, irretrievable and irreversible commitment of resources, indirect and cumulative impacts, and compliance with Executive Order 12898 are also discussed.

5.1.1 116-H-7 Retention Basin

This section evaluates the alternatives that deviate from the Process Document for waste site 116-H-7 retention basin. Alternatives SS-4, SS-8A, and SS-10 are applicable to this site. However, only Alternative SS-8A deviates from the Process Document and therefore will be evaluated.

Alternative SS-8A, in situ vitrification of contaminated soil, would impact transportation. This alternative would require the transport of equipment, solid waste from operations, and importing clean fill after treatment by truck onsite. The commuter traffic associated with this alternative would not be expected to cause a noticeable impact in the Tri-Cities area or on the Hanford Site.

Implementation of Alternative SS-8A for the 116-H-7 retention basins would not impact air quality in the short-term. The 116-H-7 retention basins are not known to have any organic contamination, so the emission of organic compounds during vitrification would not be a problem. Mitigative measures would be employed as needed to ensure that short-term impacts on air quality are minor and acceptable.

In situ vitrification of the contaminated soil at the 116-H-7 retention basins would not impact ecological resources. In fact, revegetation and restoration efforts would in the long term benefit natural resources.

Impacts from remediation to cultural resources co-located with the retention basins would generally be minimized by this alternative. The potential of this alternative for disturbing cultural resources is considered low. However, contaminated cultural resources would be a continuing source of concern to Native American communities.

The socioeconomic impact of this alternative would be insignificant. The number of employees involved and the income gained would be insignificant when compared with the total Tri-Cities area employment. Workers would likely come from the regional labor force. So, consistent with overall employment, income and population impact effects on housing would be insignificant.

This alternative would create minor short-term impacts to noise and visual resources. Some impact to 100 Area noise levels may occur during the in situ treatment process. Noise mitigation would be provided should noise levels become a problem. In an effort to mitigate potential impacts to visual resources, dust controls and backfilling with clean soil and contouring and revegetating would be implemented when needed.

This alternative would result in commitment of land to waste management. Institutional controls and monitoring would be required. Resources, such as federal funds, soil cover, and consumables, such as fuel, electricity, chemicals, and personal protective equipment, would be irreversibly committed.

The indirect impact of this alternative would be enhancement of the natural resources through revegetation of remediated waste sites. This alternative could add to the cumulative impact on transportation, ecological, noise, and visual resources from Hanford Site remediation.

As stated in the Process Document in Section 5.2.6.5, this alternative would comply with Executive Order 12898, Environmental Justice, because it would not disproportionately affect any group of the population more than another.

5.1.2 116-H-1 Process Effluent Trench

This section evaluates the alternatives that deviate from the Process Document for the 116-H-1 process effluent trench site. Alternatives SS-4 and SS-10 are applicable to this site. However, only Alternative SS-10 deviates from the Process Document and therefore will be evaluated.

Alternative SS-10, which includes thermal desorption, would impact transportation. This alternative would require the transport of equipment, contaminated and solid waste, and clean fill by truck onsite. The commuter traffic flow for this alternative would be considered an impact in the 100 Area.

The thermal desorption included in this alternative may impact air quality. Organics present at waste site 116-H-1 may be emitted during the thermal desorption process. However, mitigative measures would be employed as needed to ensure that these potential short-term impacts on air quality are minor and acceptable.

Excavation, thermal desorption, and disposal of the contaminated soil from the 116-H-1 process effluent trench would not impact ecological resources. In fact, revegetation and restoration efforts would, in the long-term, benefit natural resources.

The potential of this alternative for disturbing cultural resources is considered high. Actions to mitigate adverse impacts on significant cultural resources would have to be taken before implementing this alternative.

The socioeconomic impact of this alternative would be insignificant. The number of employees involved and the income gained would be insignificant when compared with the total Tri-Cities area employment. Workers would likely come from the regional labor force. so, consistent with overall employment, income, and population impact effects on housing would be insignificant.

This alternative would create minor short-term impacts to noise and visual resources during the treatment process. Noise mitigation would be provided should noise levels become a problem. In an effort to mitigate potential impacts to visual resources, dust controls and backfilling with clean soil then contouring and revegetating would be implemented when needed.

Resources, such as federal funds, soil cover, and consumables such as fuel, electricity, chemicals, and personal protective equipment would be irreversibly committed.

The indirect impact of this alternative would be an enhancement of the natural resources through revegetation. This alternative could add to the cumulative impact on transportation and cultural, noise and visual resources from Hanford Site remediation.

As stated in the Process Document, this alternative may comply with Executive Order 12898, Environmental Justice. Excavation always poses the risk of unearthing Native American burials. This risk of an adverse impact on Native American cultural resources may be disproportionately large compared to other segments of the population. This alternative would protect groups of the population with higher fish consumption patterns than the general population from contamination at the 116-H-1 process effluent trench.

5.1.3 116-H-4 Pluto Crib

Due to the elimination of contamination (through previous excavation and removal) only the No Action Alternative (SS-1) applies to the 116-H-4 pluto crib site. The deviation for this site is just an omission of alternatives, no evaluation is required.

5.1.4 Buried Pipelines

The removal/treatment/disposal alternative (SS-10) is applicable to sites that have contaminated soil. Current documentation indicates that the soil surrounding the 100-HR-1 pipelines is not contaminated (Dorian and Richards 1978). Therefore, the soil surrounding the pipelines will not require remedial action. The deviation for this site is just an omission of an alternative, no evaluation is required.

5.2 SITE-SPECIFIC DETAILED ANALYSIS

Based on the comparison presented in Table 3-1, several of the individual waste sites within the 100-HR-1 Operable Unit plug into the waste site group alternatives; therefore, the detailed analysis for these individual waste sites can be referenced to the Process Document. These individual waste sites include 132-H-1, 132-H-2, and 132-H-3.

The detailed analysis for the remaining waste sites (116-H-7, 116-H-1, 116-H-4, and 100-H pipelines) are discussed in the following sections. Table 5-1 summarizes the remedial alternatives applicable to each waste site and shows whether the detailed analysis is covered in the Process Document or discussed in this document. Tables 5-2 and 5-3 present the remediation costs and durations associated with all waste sites.

5.2.1 116-H-7 Retention Basin

This section evaluates the alternatives that deviate from the Process Document for the 116-H-7 retention basin site against the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) evaluation criteria. Alternatives SS-4, SS-8A, and SS-10 are applicable to this site. However, only Alternative SS-8A deviates from the Process Document and, therefore will be evaluated.

5.2.1.1 Overall Protection of Human Health and the Environment. Alternative SS-8A involves in situ vitrification to thermally treat organic contaminants and immobilize inorganic contaminants applicable to the 116-H-7 retention basin. Alternative SS-8A will eliminate the human health and ecological pathways in approximately 8.1 years. Workers will not be exposed to contaminants during implementation.

5.2.1.2 Compliance with ARAR. Chemical-specific ARAR for Alternative SS-8A will be met by thermal destruction and encapsulation of contaminants in the soil. Location-specific ARAR can be met through proper planning and scheduling. Action-specific ARAR are met through appropriate design and operation.

5.2.1.3 Long-term Effectiveness and Permanence. The magnitude of the remaining risk for Alternative SS-8A is expected to be minimal due to the anticipated characteristics of the vitrified material and the soil cover. Sources of risk remain, however, in situ vitrification will eliminate all exposure pathways. Long-term management in the form of institutional controls and groundwater surveillance monitoring is required. Also, maintenance of the soil cover overlying the vitrified material may be needed.

5.2.1.4 Reduction of Toxicity, Mobility, or Volume. In situ vitrification is an irreversible process that will treat all of the contaminated soil to the maximum melt depth, effectively immobilizing the contaminants in the glass melt. Hydraulic infiltration is temporarily reduced and mobilization is eliminated. There will be minimal quantities of residuals from offgas treatment as condensate and contaminated filters. However, these can be disposed of directly into the melt. The principal exposure pathways at the site are eliminated.

5.2.1.5 Short-Term Effectiveness. Risks to the community and workers during in situ vitrification include potential releases of fugitive dusts and gases. These releases can be controlled through proper operating procedures. No receptors are currently in the area. However, remedial activities can be scheduled to accommodate nesting or roosting species if encountered. All remedial action objectives are met upon completion of a remedial alternative.

5.2.1.6 Implementability. Some difficulties are associated with the implementation of in situ vitrification. Some investigation may be required in order to locate the area proposed for treatment. In addition, soil particle sizes may vary from site to site. Existence of cobble layers and structural members may affect performance. It is very unlikely that technical problems will lead to schedule delays. All necessary equipment and specialists are readily available. Long-term deed restrictions may require coordination with state groundwater agencies and with local zoning authorities.

5.2.2 116-H-1 Process Effluent Trench

This section evaluates the alternatives that deviate from the Process Document for the 116-H-1 process effluent trench site against the CERCLA evaluation criteria. Alternatives SS-4 and SS-10 are applicable to this site. However, only Alternative SS-10 deviates from the Process Document, and therefore, will be evaluated. Alternative SS-8A is applicable to the process effluent trench group, but was eliminated for 116-H-1 in the evaluation of the alternative applicability criteria in Section 3.2.

5.2.2.1 Overall Protection of Human Health and the Environment. Based on the presence of organics, Alternative SS-10 requires that thermal desorption be included for this waste site. The removal/treatment/disposal technologies associated with Alternative SS-10 will result in protectiveness of human health and the environment regardless of the additional treatment by thermal desorption. Any additional short-term risk to the workers or the community can be minimized through engineering controls and proper health and safety protocol.

5.2.2.2 Compliance with ARAR. Chemical-specific ARAR for Alternative SS-10 will be met by desorption of organic compounds from the soil. Location-specific ARAR can be met through proper planning and scheduling. Action-specific ARAR are met through appropriate design and operation.

5.2.2.3 Long-term Effectiveness and Permanence. The addition of thermal desorption to Alternative SS-10 does not change the analysis of this alternative with respect to this criterion from the Process Document. Contaminated soil exceeding preliminary remediation goals will be permanently removed from the site.

5.2.2.4 Reduction of Toxicity, Mobility, or Volume. Thermal desorption is primarily an irreversible process in which nearly all of the volatile and semivolatile constituents will be reduced. Any of the remaining volatile and semivolatile organic contaminants will be rendered immobile. Thermal desorption may completely reduce the volume of soil, producing minimal amounts of residuals that will be transferred to a disposal facility.

5.2.2.5 Short-Term Effectiveness. Risks to the community and workers during thermal desorption include potential releases of fugitive gases. These releases can be controlled through vapor abatement and proper operating procedures. No receptors are currently in the area. However, remedial activities can be scheduled to accommodate nesting or roosting species if encountered. All remedial action objectives are met upon completion of remedial alternative.

5.2.2.6 Implementability. No difficulties are anticipated with the implementation of thermal desorption despite the absence of site-specific treatability study data. An influent soil particle size limitation of 2-in. exists. It is very unlikely that technical problems will lead to schedule delays. All necessary equipment and specialists are readily available and adjustments to Alternative SS-10 are easily accomplished as thermal desorption will be an off-line process. Due to removal, post closure monitoring will not be required.

5.2.3 116-H-4 Pluto Crib

This section evaluates the alternatives that deviate from the Process Document for the 116-H-4 pluto crib sites against the CERCLA evaluation criteria. Due to the elimination of contamination (through previous excavation and removal) only Alternative SS-1 applies, and therefore, no evaluation is required.

5.2.4 Buried Pipelines

This section evaluates the 100-HR-1 pipeline sites against the CERCLA evaluation criteria. The removal/treatment/disposal alternative (SS-10) is applicable to sites which have contaminated soil. Current documentation indicates that the soil surrounding the 100-HR-1 pipelines is not contaminated (Dorian and Richards 1978). Therefore, the soil surrounding the pipelines will not require remedial action. Because the deviation for this site is just an omission of an alternative, no evaluation is required.

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Table 5.1. Waste Site Remdial Alternatives and Technologies

Alternatives		Technologies Included	Waste Site Group				
			116-H-7 Retention Basin	116-H-1 Process Effluent Trench	Buried Pipelines	116-H-4 Pluto Crib	132-H-1 132-H-2 132-H-3
No Action	SS-1 SW-1	None				O	P
Institutional Controls	SS-2 SW-2	Deed Restrictions					
		Groundwater Monitoring					
Containment	SS-3 SW-3	Surface Water Controls			P		
		Modified RCRA Barrier			P		
		Deed Restrictions			P		
		Groundwater Monitoring			P		
Removal, Disposal	SS-4 SW-4	Removal	P	P	P		
		Disposal	P	P	P		
In Situ Treatment	SS-8A	Surface Water Controls	O				
		In Situ Vitrification	O				
		Groundwater monitoring	O				
		Deed restrictions	O				
	SS-8B	Void Grouting			P		
		Modified RCRA Barrier			P		
		Surface Water Controls			P		
		Deed Restrictions			P		
		Groundwater Monitoring			P		
	SW-7	Dynamic Compaction					
		Modified RCRA Barrier					
		Surface Water Controls					
		Groundwater Monitoring					
		Deed Restrictions					
Removal, Treatment, Disposal	SS-10	Removal	P	P			
		Thermal Desorption		P,O			
		Soil Washing	P	P			
		Disposal	P	P			
	SW-9	Removal					
		Thermal Desorption					
		Compaction					
		ERDF Disposal					

Note: P - Indicates the detailed analysis which is provided in the Process Document
O - Indicates the detailed analysis which is provided in the operable unit-specific report
blank - Technology does not apply to this Waste Site
RCRA - Resource Conservation and Recovery Act
ERDF - Environmental Restoration Disposal Facility

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Table 5-2. 100-HR-1 Waste Site-Specific Alternative Costs.

Site	Containment			Removal / Disposal			In Situ Treatment			Removal / Treatment / Disposal		
	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth
100-HR-1 OPERABLE UNIT												
116-H-7 Retention Basin				$29.4M	$0	$28M	$66.9M	$54.9M	$98.0M	$31.9M	$4.05M	$34.2M
116-H-1 Process Effluent Trench				$6.08M	$0	$5.79M				$6.53M	$.825M	$7.02M
116-H-4 Pluto Crib	No interim action proposed at site											
100H PIPELINES	$9.76M	4.64M	$11.9M	$2.27M	$0.0	$2.16M	$.942M	$0.0	$.898M			
132-H-1 Reactor Exhaust Stack	No interim action proposed at site											
132-H-2 Exhaust Air Filter Building	No interim action proposed at site											
132-H-3 Effluent Pumping Station	No interim action proposed at site											

Blank Cell = Not Applicable
O&M = Operation and Maintenance
M = million

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Table 5-3. 100-HR-1 Waste Site-Specific Alternative Durations.

SITE	Containment	Removal/Disposal	In Situ Treatment	Removal/Treatment/Disposal
	Duration (yrs)	Duration (yrs)	Duration (yrs)	Duration (yrs)
100-HR-1 OPERABLE UNIT				
116-H-7 Retention Basin		0.5	8.1	1.0
116-H-1 Process Effluent Trench		0.2		0.2
116-H-4 Pluto Crib	No interim action proposed at site			
100 H PIPELINES	0.5	0.3	0.1	
118-H-5 Burial Ground	Institutional Controls proposed at site			
132-H-1 Reactor Exhaust Stack	No interim action proposed at site			
132-H-2 Exhaust Air Filter Building	No interim action proposed at site			
132-H-3 Effluent Pumping Station	No interim action proposed at site			

Blank Cell = Not Applicable

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6.0 COMPARATIVE ANALYSIS

This section presents the comparative analysis of remedial alternatives, which involves evaluation of the relative performance of each alternative with respect to the evaluation criteria presented in Section 5.0. This comparison identifies the advantages and disadvantages of each alternative so that key tradeoffs can be identified.

Following the methodology of the Process Document, the comparative analysis of the 100-HR-1 alternatives is presented in tabular format (Tables 6-1 through 6-3). The tables present the alternatives applicable to each waste site and a comparison of the relative differences between each alternative. The comparison consists of identifying the relative rank of the alternative (relative to other applicable alternatives) along with the cost[1], and a discussion of its specific advantages and disadvantages. To determine which alternative ranks highest overall for a waste site, the quantitative comparison table presents which alternatives rank highest in those criteria.

6.1 QUANTITATIVE COMPARISON OF REMEDIAL ALTERNATIVES

6.1.1 116-H-7 Retention Basin

The 116-H-7 retention basin does meet the applicability criteria for the In Situ Vitrification Treatment Alternative because of its relatively shallow depth of contamination (unlike the retention basin group presented in the Process Document).

The addition of In Situ Vitrification as a treatment alternative results in the need to reexamine the comparative analysis performed in the Process Document. The Remove/Dispose and Remove/Treat/Dispose Alternatives evaluated for retention basins in the Process Document applies directly to the 116-H-7 retention basin. In Situ Vitrification for the retention basin follows the same philosophy, detailed evaluation, and comparative analysis as was performed for the other waste sites that included ISV. The only factor that resulted in variations to the scoring for different waste sites is the size of the excavation. The long-term effectiveness, reduction in toxicity, mobility, and volume through treatment, and short-term effectiveness all remain the same score as was given to the other waste sites (a 4, 7, and 7, respectively). A score of 2 was given to the retention basins for implementability because the large area to be vitrified. As a result, Remove/Dispose is the highest ranking option followed by Remove/Treat/Dispose and then In Situ Vitrification.

6.1.2 116-H-1 Process Effluent Trench

The elimination of ISV for the 116-H-1 Process Effluent Trench leaves the two remedial alternatives to be evaluated as Remove/Dispose and Remove/Treat/Dispose. The addition of thermal desorption to the treatment process increases the score for the Reduction in Toxicity, Mobility, and Volume through Treatment by one point. The additional process

[1]Estimates of durations for each alternative are presented in Section 5.0, Table 5-2.

slightly reduces the short-term effectiveness and implementability categories. This reduction is so slight that a reduction in the score originally given to these categories is not warranted. However, as can be seen in the scoring of the cost category, a reduction in score in the cost category by one point is required.

6.1.3 116-H-4 Pluto Crib

The 116-H-4 pluto crib site was excavated from its original location in 1960. The excavation debris was then buried in the 118-H-5 burial ground to accommodate the construction of the 132-H-2 filter building. (The 118-H-5 burial ground will be addressed as part of the 100-HR-2 Operable Unit). No contaminants of concern were identified at the 116-H-4 pluto crib site; therefore, the no action alternative is the preferred alternative. The no action alternative meets all CERCLA criteria evaluated for action alternatives for this waste site. The 116-H-4 pluto crib will be addressed as part of future remedial actions for the 100-HR-1 Operable Unit.

6.1.4 100-H Buried Pipelines

The reason for eliminating the treatment option for Remove/Treat/Dispose alternative is the lack of contaminated soils around the buried pipelines. This lack of contaminated soil has its benefits from a cost and environmental cleanup perspective but increases the difficulties for short-term effectiveness and implementability from the need to create staging areas and double handling of the clean fill that would be placed back into the hole. As a result the score for these two categories have been reduced by one point. This results in Remove/Dispose to still be the highest ranking alternative, but In Situ Grouting is now less than one point behind the Remove/Dispose Alternative.

Table 6-1. Quantitative Comparison of Evaluation Criteria for 116-H-7 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	7.00	3.50	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	8.00	8.00
Total Rank[b]			31.0			16.00			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-2. Quantitative Comparison of Evaluation Criteria for 116-H-1 Process Effluent Trenches.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-3. Quantitative Comparison of Evaluation Criteria for 100-H Buried Pipelines.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Containment			Removal/Disposal			In Situ Grouting		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	2.00	2.00	1.00	7.00	7.00	1.00	3.00	3.00
Reduction of Mobility or Volume	0.50	1.00	0.50	0.50	3.00	1.50	0.50	2.00	1.0
Short-Term Effectiveness	0.50	7.00	3.50	0.50	6.00	3.00	0.50	6.00	3.00
Implementability	1.00	3.00	3.00	1.00	7.00	7.00	1.00	2.00	2.00
Cost	1.00	1.00	1.00	1.00	4.00	4.00	1.00	10.00	10.00
Total Rank[b]			10.0			22.5			19.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

7.0 COMPARATIVE ANALYSIS FOR NEW REMEDIATION CONCEPT

As discussed in the Introduction, the detailed analysis and comparative analysis performed in Sections 5.0 and 6.0 above were based on the baseline scenario described in the Process Document. The Sensitivity Analysis and New Remediation Concept (Appendix D) evaluated several different land use scenarios and resulted in a modification to the baseline scenario. This new remediation concept is discussed in detail in Appendix D and establishes regulatory bases for protection of human health, ecological protection, groundwater protection, and surface water protection. An evaluation of the effects of this new remediation concept on the analysis presented in the Process Document was performed in Appendix D. The impacts of this new remediation concept that effect the work performed in this FFS Appendix are as follows:

- In Situ Vitrification (ISV) and Containment are no longer alternatives that can be used for the waste sites evaluated in this FFS because they preclude potential future uses of the area impacted by the waste site.

- The magnitude of excavation (predominantly depth) has been reduced, thus reducing cost by 32% and 30% for Remove/Dispose and Remove/Treat/Dispose alternatives, respectively.

- The relative effects on the key discriminators that are used to evaluate and compare the alternatives are similar for both Remove/Dispose and Remove/Treat/Dispose.

7.1 HR-1 FFS IMPACTS

The prior discussions relating to the application of the plug-in approach, alternative development, and detailed analysis of alternatives are all still directly applicable to the new remediation concept. The fundamental changes from the new remediation concept (ISV and containment eliminated and reduction in extent of excavation) do not adversely affect the process or results of the plug-in approach. No new deviations to the plug-in approach have been identified and thus no new alternative development is required. The Remove/Dispose and Remove/Treat/Dispose detailed analysis generated in the Process Document and Section 5.0 of this attachment are changed only minimally due to the reduced extent of excavation. The risk, impacts, and adverse effects of the Remove/Dispose and Remove/Treat/Dispose Alternatives on workers, human health, and the environment are similar and do not warrant a change to the detailed evaluation. The comparative analysis, however, requires elimination of the ISV and containment alternatives and require a recalculation of cost scoring. This difference in the reduction in costs is minimal and should not change the scores for these two alternatives.

7.2 NEW REMEDIATION CONCEPT QUANTITATIVE COMPARISON OF REMEDIAL ALTERNATIVES

7.2.1 116-H-7 Retention Basins

With the elimination of ISV as an alternative for the 116-H-7 retention basin, now only Remove/Dispose and Remove/Treat/Dispose are applicable to these retention basins. The scoring and ranking, as applied in the Process Document and in this FFS Appendix, are still valid except for costs. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, did not change the score of the cost category. This reduction in excavation does not change the relative advantages and disadvantages of the alternatives. The comparative analysis tables, based on the new remediation concept for 116-H-7, is given in Table 7-1.

7.2.2 116-H-1 Process Effluent Trench

The 116-H-1 Process Effluent Trench has already eliminated the ISV alternative for technical reasons. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, changes the score of the cost category to 10 and 8, respectively. The results are provided in Table 7-2.

7.2.3 100-H Buried Pipelines

The 100-H Pipelines have eliminated the treatment alternative because of site-specific information, and thus, with the elimination of ISV and containment, remove/dispose is the only viable alternative to be considered.

7.2.4 116-H-4 Pluto Crib

The 116-H-4 Pluto Crib was removed and buried in waste site 118-H-5 burial ground in the past; therefore, no action is warranted at the site.

Table 7-1. New Remediation Concept for Quantitative Comparison of Evaluation Criteria for 116-H-7 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.50
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			31.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-2. New Remediation Concept for Quantitative Comparison of Evaluation Criteria for 116-H-1 Process Effluent Trench.

CERCLA Evaluation Criteria	**Remedial Alternatives**					
	Removal/Disposal			**Removal/Treatment/ Disposal**		
	Weight	Score	Rank[(a)]	Weight	Score	Rank[(a)]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.50	0.50	5.00	2.50
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[(b)]			29.0			26.0

[(a)]Rank = weight x score
[(b)]Total Rank = sum of individual rankings

8.0 REFERENCES

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ATTACHMENT 1

WASTE SITE VOLUME ESTIMATES

Volume Estimate
100-HR-1 Operable Unit

OBJECTIVE:

Provide estimates of:

- The volume of contaminated materials within selected waste sites in the 100-HR-1 Operable Unit.
- The volume of materials which will need to be excavated to remove the contaminated materials.
- The areal extent of contamination.

Estimates are provided for the following waste sites:

Site Number	Site Name	Page
116-H-1	107-H Liquid Waste Disposal Trench	E-63
116-H-4	105-H Pluto Crib	E-65
116-H-7	107-H Retention Basin	E-66
132-H-1	Reactor Exhaust Stack	E-68
132-H-2	117-H Filter Building	E-69
132-H-3	1608-H Wastewater Pumping Station	E-70
Pipelines	107-H Process Pipelines	E-71

Volume Estimate
100-HR-1 Operable Unit

METHOD:

The following steps are used to calculate volumes and areas for each waste site:

- Estimate the dimensions of each waste site.
- Estimate the location of the site.
- Estimate the extent of contamination present at each site.
- Estimate the extent of the excavation necessary to remove the contamination present.
- Calculate the volume of contamination present, the volume of material to be removed, and the areal extent of contamination.

Waste Site Dimensions -
Dimensions of the waste site are derived from all pertinent references. The reference used is noted in brackets [].

Waste Site Location -
Location of the waste site is derived from pertinent references, confirmed by field visit. The specific reference or method used to locate each site is discussed in a separate brief (see reference 9). Coordinates for each waste site are converted to Washington State coordinates (see reference 9). Resulting Washington State coordinates are presented herein.

Contaminated Volume Dimensions -
The extent of contamination present at the waste site is estimated from analytical data which exists for the site. The data used, assumptions made, and method for estimating extent is discussed in a separate brief (see reference 10). Dimensions are summarized herein.

Excavated Volume Dimensions -
The extent of the excavation necessary to remove the contamination is based on a 1.5 H : 1.0 V excavation slope with the extent of contamination at depth serving as the bottom of the excavation.

Volume and Area Calculations -
The above information is used to construct a digital terrain model of each site within the computer program AutoCad. The computer program DCA is then used to calculate volumes and areas for the waste site.

ASSUMPTIONS:

The following assumptions were used to locate and/or provide dimensions for a waste site if no other data exists. See reference 10 for assumptions concerning extent of contamination and reference 9 for assumptions concerning location of the waste site.

Volume Estimate
100-HR-1 Operable Unit

ASSUMPTIONS (continued):

Burial Grounds -
- Burial ground dimensions are 20 ft wide at the bottom, 20 ft deep, and have 1.0 H : 1.0 V side slopes.
- Five feet of additional cover was provided.
- Burial grounds were filled completely.

Liquid Waste Sites -
- Trenches were built with 1.0 H : 1.0 V side slopes.
- Tops of cribs are 6 ft below grade.

The following assumptions were used in calculating volumes and areas:
- No site interferences or overlaps are considered, volumes and areas are calculated for each waste site separately.

All depths are below grade unless noted.

REFERENCES:

1. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1994, Hanford Site Waste Information Data System (WIDS), Richland, Washington.

2. 100-H Area Technical Baseline Report.

3. Hanford Site Drawings and Plans (P-1220, P-1221, M-1904-H, Sheet 4).

4. Site topographic maps, Drawings.

5. Historical photographs of the 100-H Area (#9621, Box 16273).

6. Dorian, J.J., and V.R. Richards, "Radiological Characterization of the Retired 100 Areas", UNI-946, May 1978, United Nuclear Industries, Richland, Washington.

7. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1993, "Limited Field Investigations Report for the 100-HR-1 Operable Unit. DOE/RL-93-51, Draft A, U.S. Department of Energy, Richland, Washington.

8. Limited Field Investigation Report for 100-HR-3 OU.

9. IT Corporation, 1994, "100-HR-1 Waste Site Locations", IT Corporation Calculation Brief, Project Number 199806.409.

10. IT Corporation, 1994, "100-HR-1 Waste Site Contaminated Extent", IT Corporation Calculation Brief, Project Number 199806.409.

Volume Estimate
100-HR-1 Operable Unit

REFERENCES (continued):

11. IT Corporation, 1994, "100-HR-1 Pipe Locations", IT Corporation Calculation Brief, Project Number 199806.409.

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 116-H-1
SITE NAME: 107-H Liquid Waste Disposal Trench

WASTE SITE DIMENSIONS:

Length - 106 ft (32.3 m) along bottom, 193 ft (58.8 m) at surface [5]
Width - 37 ft (11.2 m) along bottom, 110 ft (33.5 m) at surface [5]
Depth - 15 ft (4.6 m) [5]
Slopes - Varies
Orientation - North-South [5]

Waste site consists of three lobes that were oriented from north to south [2]. Second lobe bottom is 405 ft x 120 ft (123.4 m x 36.6 m), third lobe bottom is 377 ft x 120 ft (114.9 m x 36.6 m) [5]. Second and third lobes appear to be approximately 5 ft deep [5]. Waste site has been backfilled to the surface [1]. The second and third lobes have not been documented as being used, therefore are not considered in the contaminated volume.

CONTAMINATED VOLUME DIMENSIONS:

Trench was filled to graded with liquids, side slopes and substrate are contaminated from the surface to groundwater [10].

Length - 193 ft (58.8 m) [10]
Width - 110 ft (33.5 m) [10]
Depth - 20 ft (6.1 m) [10]

EXCAVATED VOLUME DIMENSIONS:

Base of excavation is 193 ft (58.8 m) long by 110 ft (33.5 m) wide at a depth of 20 ft (6.1 m).

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing:	152,452 [9]	Northing:	152,420 [9]
Easting:	578,087 [9]	Easting:	578,087 [9]
	Center of N edge		Center of S edge

ELEVATIONS:

Surface: 418 ft (127.5 m) [6]
Groundwater: 376 ft (114.5 m) [8]

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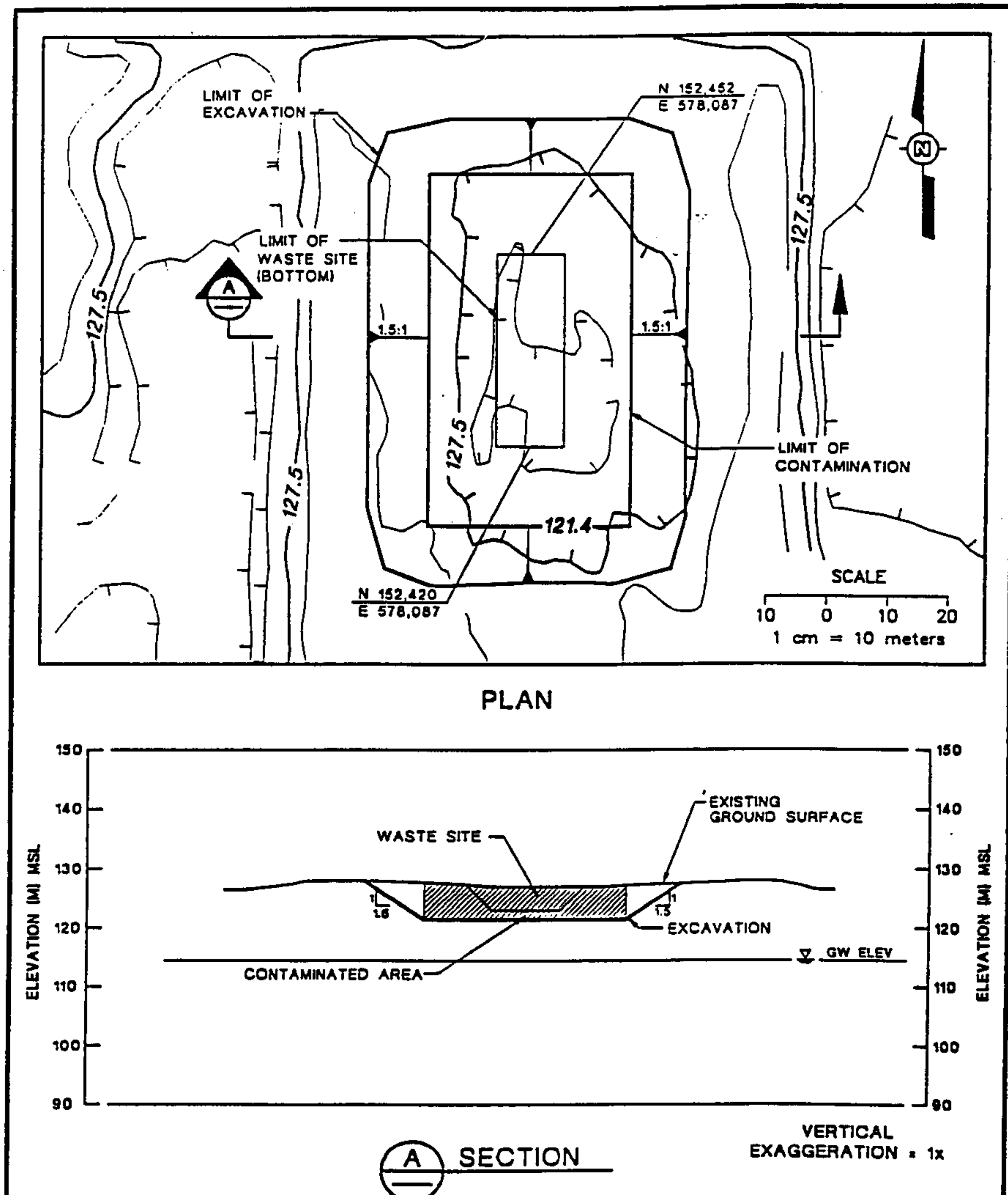
Figure 1. Interim Remedial Measures Site: 116-H-1.

Figure 1 IRM Site: 116-H-1



EXTENT OF CONTAMINATION

SURFACE AREA = 1,970 sq. meters
VOLUME = 12,015 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 3,951 sq. meters
VOLUME = 17,142 cu. meters

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 116-H-4
SITE NAME: 105-H Pluto Crib

WASTE SITE DIMENSIONS:

Length - 10 ft (3.1 m) [2]
Width - 10 ft (3.1 m) [2]
Depth - 10 ft (3.1 m) [2]
Slopes - Vertical
Orientation - North-South

Waste site was covered with 10 ft (3.1 m) of soil then exhumed and moved to 118-H-5 burial ground [1,2].

CONTAMINATED VOLUME DIMENSIONS:

Site was excavated and removed for construction of the 117-H filter building. It is assumed that during construction of the 117-H filter building all contaminants at depth were removed [10]. Assume no contaminated volume.

EXCAVATED VOLUME DIMENSIONS:

Not Applicable.

WASTE SITE LOCATION:

Northing: 152,479 [9]
Easting: 577,706 [9]

Reference Point: Center of crib.

ELEVATIONS:

Surface: 421 ft (128.5 m) [4]
Groundwater: 376 ft (114.7 m) [8]

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 116-H-7
SITE NAME: 107-H Retention Basin

WASTE SITE DIMENSIONS:

Length - 632 ft (192.6 m) [3,5]
Width - 276 ft (84.1 m) [3,5]
Depth - 20 ft (6.1 m) [2], bottom of basin @ elevation 396 ft (120.7 m) [4]
Slopes - Vertical
Orientation - Lengthwise N-S

Site was backfilled to 4 ft (1.2 m) above floor [1].

CONTAMINATED VOLUME DIMENSIONS:

Contamination extends 15 ft (4.5 m) in all directions [10].

Length - 662 ft (201.8 m) [10]
Width - 306 ft (93.3 m) [10]
Depth - 10 ft (3.0 m) [10] (below top of basin fill)

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation corresponds with contamination limits.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,745 [9]
Easting: 578,044 [9]

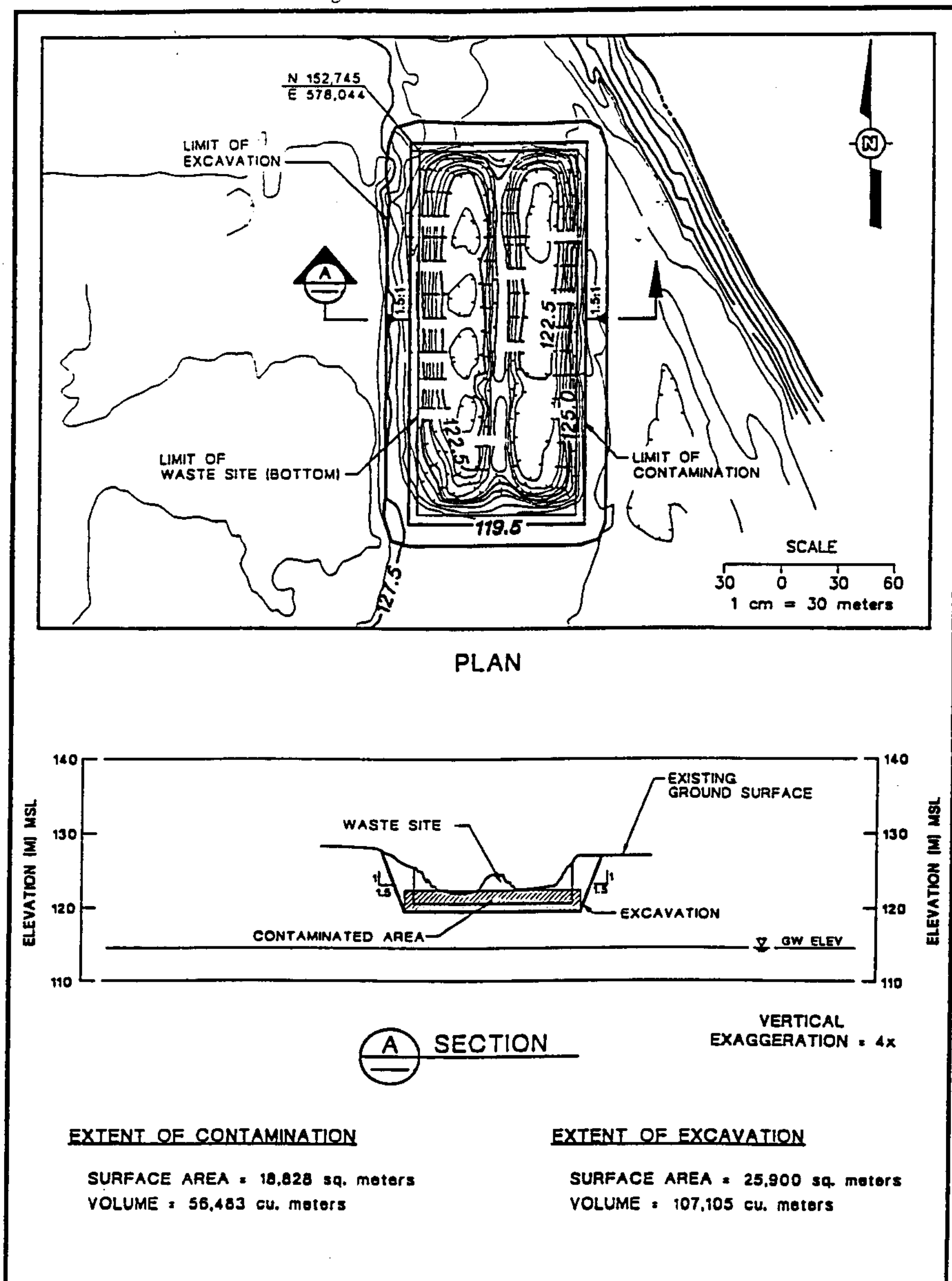
Reference Point: Northwest corner

ELEVATIONS:

Surface: 402 ft (122.5 m) [4]
Groundwater: 376 ft (114.6 m) [8]

Figure 2. Interim Remedial Measures Site: 116-H-7.

Figure 2 IRM Site: 116-H-7



Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 132-H-1
SITE NAME: Reactor Exhaust Stack

WASTE SITE DIMENSIONS:

Length - 200 ft (61.0 m) along bottom, 220 ft (67.1 m) at top of trench [2]
Width - 5 ft (1.5 m) along bottom, 25 ft (7.6 m) at top of trench [2]
Depth - 15 ft (4.6 m) [2]
Slopes - 1.0 H : 1.0 V
Orientation - East-West lengthwise

Stack was decontaminated, demolished, and buried between 117-H and 105-H buildings [2]. Site has been covered with 5 ft (1.5 m) of clean fill

CONTAMINATED VOLUME DIMENSIONS:

The site was decontaminated and decommissioned to ARCL methodology. Contamination is not expected at the site.

EXCAVATED VOLUME DIMENSIONS:

Not Applicable.

WASTE SITE LOCATION:

Northing: 152,504 [9]
Easting: 577,737 [9]

Reference Point: Center of east side of bottom of trench.

ELEVATIONS:

Surface: 418 ft (127.5 m) [4]
Groundwater: 376 ft (114.7 m) [8]

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 132-H-2
SITE NAME: 117-H Filter Building

WASTE SITE DIMENSIONS:

Length - 74 ft (22.6 m) [5]
Width - 41 ft (12.5 m) [5]
Depth - 29 ft (8.8 m) [1]
Slopes - Vertical
Orientation - East-West lengthwise

Site was originally 35 ft (10.7 m) tall with 32 ft (9.7 m) below grade [wids]. It was demolished in situ with 3 ft (1 m) of cover.

CONTAMINATED VOLUME DIMENSIONS:

The site was decontaminated and decommissioned to ARCL methodology. Contamination is not expected at the site.

EXCAVATED VOLUME DIMENSIONS:

Not Applicable.

WASTE SITE LOCATION:

Northing: 152,495 [9]
Easting: 577,698 [9]

Reference Point: Northwest corner

ELEVATIONS:

Surface: 418 ft (127.5 m)
Groundwater: 376 ft (114.7 m)

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER: 132-H-3
SITE NAME: 1608-H Wastewater Pumping Station

WASTE SITE DIMENSIONS:

Length - 36 ft (11.0 m) [2]
Width - 34 ft (10.4 m) [2]
Depth - 3 ft (1.0 m) to 32 ft (9.7 m) [2]
Slopes - Vertical
Orientation - North-South lengthwise

Site was originally 44 ft (10.7 m) tall with 32 ft (9.7 m) below grade [2]. It was demolished in situ with 3 ft (1 m) of cover.

CONTAMINATED VOLUME DIMENSIONS:

The site was decontaminated and decommissioned to ARCL methodology. Contamination is not expected at the site.

EXCAVATED VOLUME DIMENSIONS:

Not Applicable.

WASTE SITE LOCATION:

Northing: 152,480 [9]
Easting: 577,744 [9]

Reference Point: Northeast corner

ELEVATIONS:

Surface: 418 ft (127.5 m)
Groundwater: 376 ft (114.7 m)

Volume Estimate
100-HR-1 Operable Unit

SITE NUMBER:
SITE NAME: Effluent Pipelines (soil and sludge)

WASTE SITE DIMENSIONS:

Length - 2,961 ft (902.5 m) [3]
Width - 5 ft (1.5 m) diameter [3]
Depth - Varies [11]
Slopes - Varies
Orientation - Varies

Length - 1,068 ft (325.5 m) [3]
Width - 20" (0.51 m) [3]
Depth - Varies [11]
Slopes - Varies
Orientation - Varies

CONTAMINATED VOLUME DIMENSIONS:

Soil around pipe- No contamination along length of pipe.

Sludge inside pipe- All pipes have contaminated sludge along bottom. Volume of sludge is insignificant, the volume calculated will be that of pipe void.

EXCAVATED VOLUME DIMENSIONS:

Depends on depth of pipe. Base of excavation is 2 ft (0.6 m) on each side of the pipe and begins 3 inches below invert of pipe.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

See figure.

ELEVATIONS:

See figure.

Figure 3. Interim Remedial Measures Site: 100-H Buried Pipelines.

Figure 3 IRM Site: 100-H Pipelines

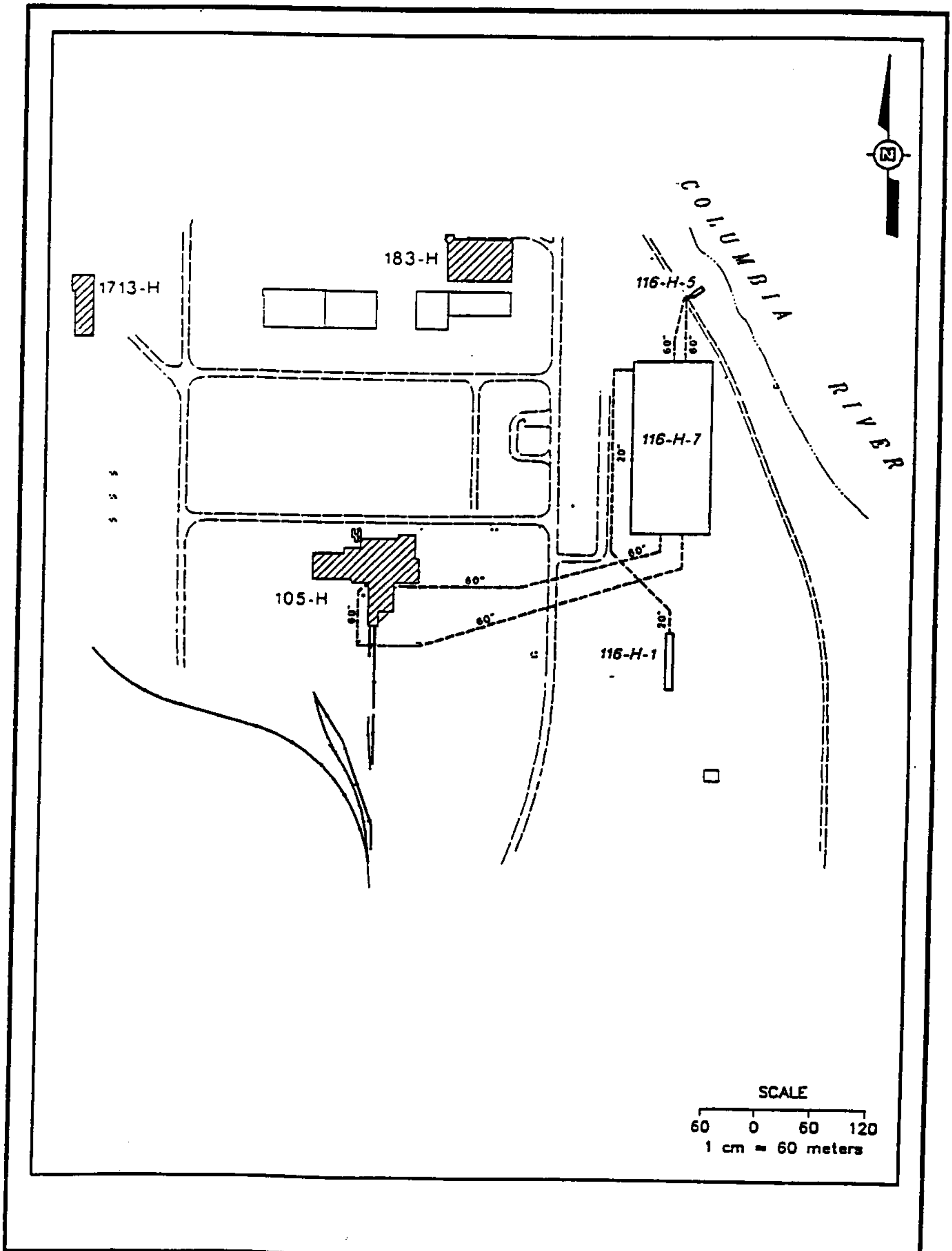
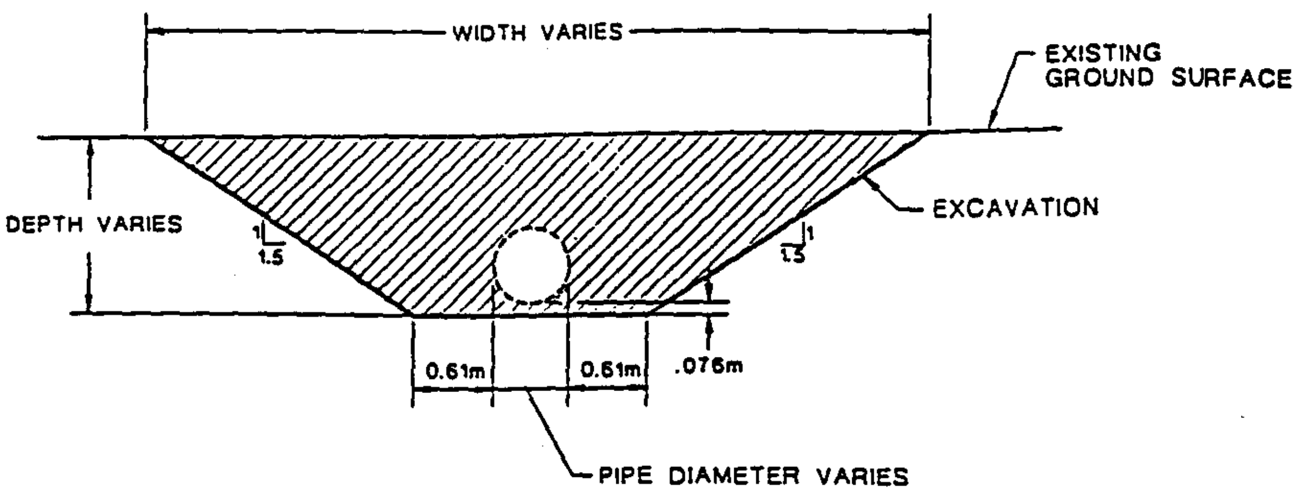


Figure 4. Typical Pipeline Excavation Cross Section.

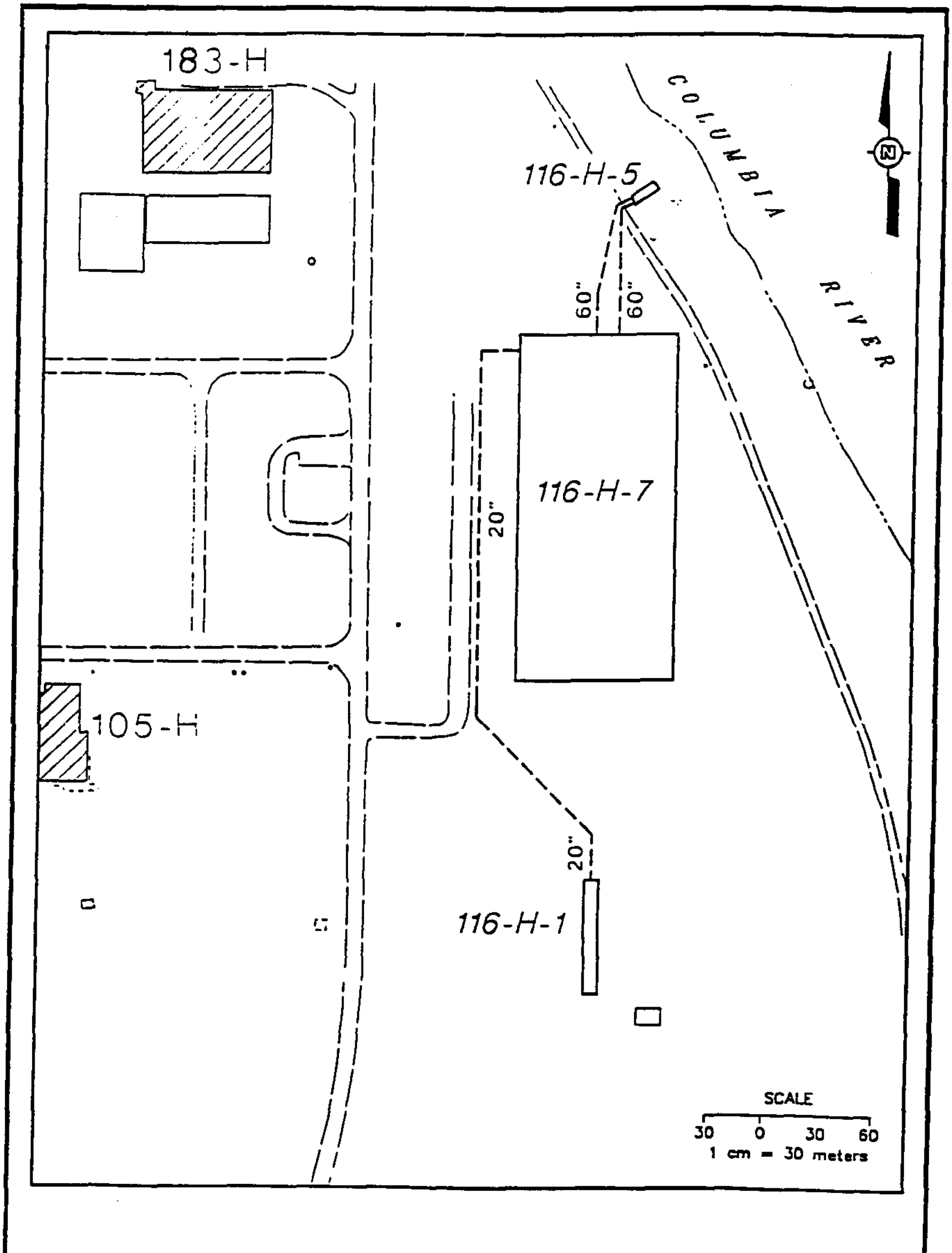
Figure 4 Typical Pipeline Excavation Cross Section



TYPICAL CROSS SECTION

Figure 5. 100-H 20 inch Pipelines.

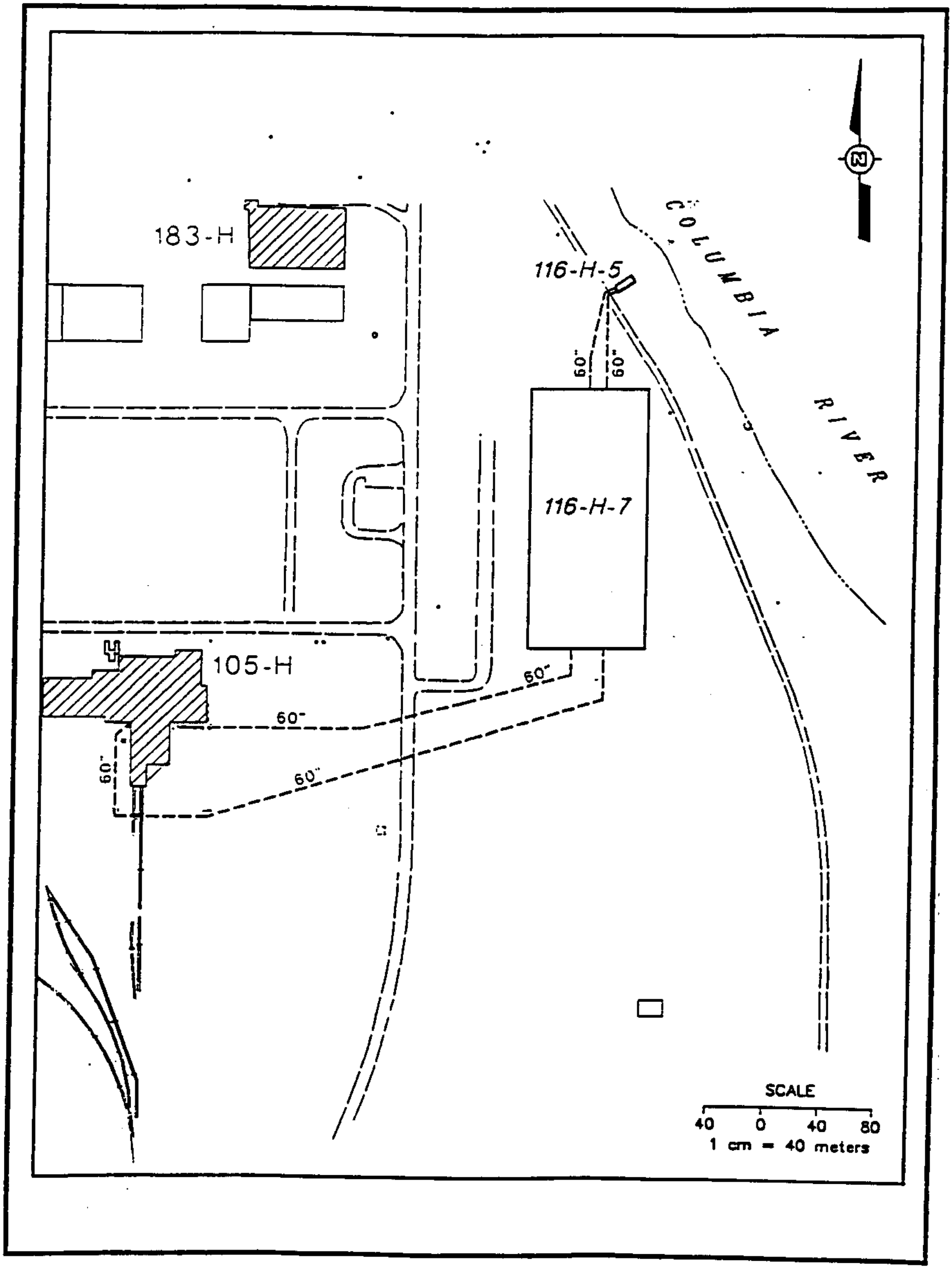
Figure 5 100-H 20 inch Pipelines



PLN20H

Figure 6. 100-H 60 inch Pipelines.

Figure 6 100-H 60 inch Pipelines



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ATTACHMENT 2

100-HR-1 OPERABLE UNIT WASTE SITE COST ESTIMATES

1.0 COST ESTIMATE SUMMARIES

This appendix has two primary purposes. The first is to describe the cost models developed to support the source operable unit focused feasibility study reports. The second is to document the cost estimates developed for each waste site using the cost models.

1.1 DESCRIPTION OF COST MODELS

A cost model defines the remedial alternative activities and provides a method in which to estimate the associated cost. Each cost model is developed using the MCACES[1] software package.

The focused feasibility study cost models are based on the Environmental Restoration cost models used for developing the fiscal year planning baselines. The Environmental Restoration cost models were modified for the source operable unit focused feasibility studies to include all costs associated with the remedial alternatives. Project Time and Cost, Inc., supported both the baseline and focused feasibility study cost estimating activities. The fourteen cost models associated with the source operable unit focused feasibility studies are presented in the *100 Area Source Operable Unit Focused Feasibility Study Cost Models* (WHC 1994).

All cost models were developed based on a common work breakdown structure. There are three main elements within the structure; Offsite Analytical Services (ANA), Fixed Price Contractor (SUB), and the Environmental Restoration Contractor (ERC). Each of the three main elements is defined further by additional levels. Table B-1 describes each element and level of a cost model. The work breakdown structure discussion is applicable for each cost model.

1.2 WASTE SITE COST ESTIMATES

Cost estimates were developed for each waste site addressed by the focused feasibility study based on the applicable cost model. The present worth for each estimate is based on a 5% discount rate and a disposal fee of \$70/cubic yard. Due to current uncertainty as to the actual disposal fee, a sensitivity analysis is presented based on \$700/cubic yard and \$7,000/cubic yard besides \$70/cubic yard. A matrix of the waste site, cost estimate table, and cost comparison figure is presented on Table B-2.

1 MCACES: Micro Computer Aided Cost Estimating System.

2 The cost model terminology has not been updated to reflect the current change in the environmental restoration primary contractor.

Table 1. 116-H-7 Retention Basin Disposal Cost Comparison[a].

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	513,620	-	964,090
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	89,650	75,170	81,697
SUB:02	Monitoring, Sampling & Analysis	194,690	119,320	479,882
SUB:08	Solids Collection & Containment	683,550	324,360	1,114,691
SUB:13	Physical Treatment	-	-	4,210,439
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	54,987,930	-
SUB:18	Disposal (Other than Commercial)	11,353,920	-	8,658,098
SUB:20	Site Restoration	1,719,930	1,131,090	1,768,917
SUB:21	Demobilization	18,610	17,440	17,087
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	390,960	4,926,780	917,727
ERC:08	Solids Collection & Containment	40,100	817,870	98,482
Subcontractor Materials Procurement Rate		140,600	566,550	163.308
Project Management/Construction Management		2,194,800	9,444,980	2,626,549
General & Administration/Common Support Pool		4,290,840	18,464,930	5,134,904
Contingency		7,787,260	30,897,990	9,707,272
Total		29,418,520	121,774,430	35,943,144
Capital		29,418,520	66,915,600	31,890,902
Annual Operations & Maintenance		0	6,772,695	4,052,242
Present Worth		28,022,466	97,972,216	34,242,818
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-8A/S-8B/SW7: In Situ Treatment SS-10/SW-9: Removal/Treatment/Disposal		1.0 10	3.496 3	1.22 8

[a]The cost model work breakdown structure is explained in Table ___ of the Process Document.

Table 2. 116-H-1 Process Effluent Trench Disposal Cost Comparison.

Cost Element		SS-4	SS-10
ANA: Offsite Analytical Services			
ANA:02	Monitoring, Sampling & Analysis	138,930	235,760
SUB: Fixed Price Contractor			
SUB:01	Mobilization & Preparatory	61,290	67,940
SUB:02	Monitoring, Sampling & Analysis	58,950	89,580
SUB:08	Solids Collection & Containment	119,860	142,910
SUB:13	Physical Treatment	-	986,430
SUB:14	Thermal Treatment	-	-
SUB:15	Stabilization/Fixation	-	-
SUB:18	Disposal (Other than Commercial)	2,038,160	1,417,850
SUB:20	Site Restoration	411,940	358,950
SUB:21	Demobilization	15,050	15,240
ERC: Environmental Restoration Contractor			
ERC:02	Monitoring, Sampling & Analysis	134,830	233,540
ERC:08	Solids Collection & Containment	10,200	21,100
Subcontractor Materials Procurement Rate		197,480	224,760
Project Management/Construction Management		457,160	533,740
General & Administration/Common Support Pool		893,760	1,043,470
Contingency		1,542,790	1,987,370
Total		6,080,400	7,358,630
Capital		6,080,400	6,533,600
Annual Operations & Maintenance		0	825,030
Present Worth		5,793,890	7,018,407

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table 3. Effluent Buried Pipelines Disposal Cost Comparison.

Cost Element		SS-3	SS-4	SS-8B
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	-	63,150	-
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	28,130	48,040	17,630
SUB:02	Monitoring, Sampling & Analysis	-	84,900	-
SUB:08	Solids Collection & Containment	4,032,330	293,990	428,890
SUB:13	Physical Treatment	-	-	-
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	-	-
SUB:18	Disposal (Other than Commercial)	-	10,070	-
SUB:20	Site Restoration	463,150	407,980	-
SUB:21	Demobilization	8,750	11,160	8,650
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	179,870	154,350	25,880
ERC:08	Solids Collection & Containment	4,220	21,100	1,410
Subcontractor Materials Procurement Rate		330,860	62,500	4,550
Project Management/Construction Management		757,100	164,110	73,050
General & Administration/Common Support Pool		1,480,130	320,840	142,820
Contingency		2,476,740	624,030	238,980
Total		9,761,290	2,266,210	941,870
Capital		9,761,290	2,266,210	941,870
Annual Operations & Maintenance		201,617	0	0
Present Worth		11,887,957	2,160,625	897,876
SS-3/SW-3: Containment				
SS-4/SW-4: Removal/Disposal		13.24	2.41	
SS-8A/SS-8B/SW-7: In Situ Treatment				
SS-10/SW-9: Removal/Treatment/Disposal		1	4	

ATTACHMENT 3

ARAR TABLES

Table 1. Potential Federal ARARs.

Chemical Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected*
Atomic Energy Act of 1954, as amended	42 U.S.C. 2011 et seq.	Authorizes DOE to set standards and restrictions governing facilities used for research, development, and utilization of atomic energy.		
Department of Energy Occupational Radiation Protection (Final Rule)	10 CFR 835	Establishes occupational and visitor radiological exposure limits.	Adheres to DOE Radiological Control Manual DOE/EH-02561 which is encompassed within the Hanford Site Radiological Control Manual.	
Nuclear Regulatory Commission Standards for Protection Against Radiation	10 CFR Part 20 Subpart C	Sets occupational dose limits for adults. Total effect dose equivalent equal to 5 rem/year.	Occupational dose limits will be followed during remediation in radiological areas.	All

*No action and institutional control alternatives are not considered.

Table 1. Potential Federal ARARs.

Location Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Archaeological and Historical Preservation Act of 1974	16 U.S.C. 469	Requires action to recover and preserve artifacts in areas where activity may cause irreparable harm, loss, or destruction of significant artifacts.	Applicable when remedial action threatens significant scientific, prehistorical, historical, or archeological data.	All
Archaeological Resources Protection Act of 1979	16 U.S.C. 470aa mm (1990)	Provides for protection of archaeological and traditional cultural properties associated with archaeological sites. Requires notification of Indian Tribes of possible harm to or destruction of sites having religious or cultural significance.	Applicable when remedial action threatens archaeological and traditional cultural properties.	All
Protection of Archaeological Resources	43 CFR Part 7	Establishes procedures to be followed by federal land managers to protect archaeological resources on federal lands. Sets civil and criminal penalties for violations; protects confidentiality of archaeological resource information.	Applicable when remedial action threatens archaeological resources.	All
American Indian Religious Freedom Act of 1978	42 U.S.C. 1996	Provides for access by Native Americans to religious sites and development of mitigation measures if actions will deny such access. Requires agency to consult with traditional religious leaders regarding activities that might affect religious sites.	Applicable when remedial action threatens Native American religious sites.	All
The Religious Freedom Restoration Act of 1993	42 U.S.C. 2000bb; P.L. 103-141	Requires agency to demonstrate compelling need for a project that will deny the free exercise of religion by Native Americans. If activities threaten access to religious site consultation with tribes will be necessary.	Applicable when remedial action threatens Native American religious sites.	All
Antiquities Act of 1906	16 U.S.C. 431-433	Provides for the protection of all historic and prehistoric ruins and objects of antiquity located on Federal lands. Provides for criminal sanctions against excavation, injury, or destruction of such resources.	Applicable when remedial action threatens historic or prehistoric ruins.	All
Endangered Species Act of 1973	16 U.S.C. 1531 et seq.	Prohibits federal agencies from jeopardizing threatened or endangered species or adversely modifying habitats essential to their survival. If waste site remediation is written sensitive habitat or buffer zone surrounding threatened and endangered species, mitigation measures must be taken to protect this resource.	This law is applicable as threatened or endangered species have been identified with the 100 Area.	All
Migratory Bird Treaty Act	16 U.S.C. 703 et seq. 50 CFR 10-24	Makes it illegal to pursue, hunt, take, capture, kill, possess, trade, or transport any migratory bird, part, nest, or egg included in the terms of the conventions between the U.S. and Great Britain, the U.S. and Mexico, and the U.S. and Japan. Although this Act does not require ecological assessments be done for federal agency projects, if a disturbance is expected in an area where migratory birds may be affected, such an assessment should be done to ensure the law's intent.	If remedial actions potentially impact migrating birds, this act is applicable.	
Fish and Wildlife Services List of Endangered and Threatened Wildlife and Plants	50 CFR Parts 17, 222, 225, 226, 227, 402, 424	Requires identification of activities that may affect listed species. Actions must not threaten the continued existence of a listed species or destroy critical habitat. Requires consultation with the Fish and Wildlife Service to determine if threatened or endangered species could be impacted by activity.	This law is applicable as threatened or endangered species have been identified with the 100 Area.	All

Table 1. Potential Federal ARARs.

Location Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Historic Sites, Buildings, and Antiques Act	16 U.S.C. 461	Establishes requirements for preservation of historic sites, buildings, or objects of national significance. Undesirable impacts to such resources must be mitigated.	Applicable to properties listed in the National Register of Historic Places, or eligible for such listing.	All
ational Historic Preservation Act of 1966, as amended.	16 U.S.C. 470 et seq.	Prohibits impacts on cultural resources. Where impacts are unavoidable, requires impact mitigation through design and data recovery.	Applicable to properties listed in the National Register of Historic Places, or eligible for such listing.	All
rotection of Historic Properties	36 CFR 800	Sets criteria for assessing effects, for developing mitigation measures to address unavoidable adverse impacts, and for addressing properties discovered during implementation of an undertaking.	Applicable when remedial action threatens a historic property discovered during remedial activity.	All
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001-3013 Public Law 101-601 (1993)	Requires action by federal agency when Native American human remains and associated funerary objects are inadvertently discovered during construction. Requires work stoppage, protection of items, and notification to appropriate Indian Tribes. Construction activities may resume 30 days after certification that agency head and Indian Tribes have been notified.	Applicable if, during remedial action, Native American human remains or burial objects are discovered	All
Floodplains/Wetlands Environmental Review	10 CFR Part 1022	Requires federal agencies to avoid, to the extent possible, adverse effects associated with the development of a floodplain or the destruction or loss of wetlands.	Applicable if remedial activities take place in a floodplain or wetlands.	All

Table 1. Potential Federal ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Clean Air Act, as amended	42 U.S.C. 7401 et seq.	A comprehensive environmental law designed to regulate any activities that affect air quality, providing the national framework for controlling air pollution.		
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes numerical standards for hazardous air pollutants.		
Radionuclide Emissions from DOE Facilities (except Airborne Radon-222, and Radon-220)	40 CFR 61.92	Prohibits emissions of radionuclides to the ambient air exceeding an effective dose equivalent of 10 mrem per year.	Applicable to incinerators and other remedial technologies where air emission may occur.	SW-4, SW-7, SW-9, SS-4, SS-8, SS-10
Emission Standards for Asbestos for Waste Disposal Operations for Demolition and Renovation	40 CFR 61.150	States there must either be no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or specified waste treatment methods must be used.	Applicable to recovery and handling of asbestos wastes.	SW-4, SW-7, SW-9.
Asbestos Standard for Active Waste Disposal Sites	40 CFR 61.154	States there must either be no visible emissions to the outside air during the collection, processing (including incineration), packaging, or transporting of any asbestos-containing waste material generated by the source, or specified waste treatment methods must be used.	Applicable to landfill disposal of asbestos.	SW-4, SW-9
Protection of Stratospheric Ozone	40 CFR 82	Management of refrigerant systems.	Applicable to all buildings/facilities containing refrigerant systems.	All
Federal Water Pollution Control Act (FWPCA), as amended by the Clean Water Act of 1988 (CWA)	33 U.S.C. 1251 et seq.	Creates the basic national framework for water pollution control and water quality management in the United States.	Applicable to discharges of pollutants to navigable waters.	
The National Pollutant Discharge Elimination System (NPDES)	40 CFR Part 122	Part 122 covers establishing technology-based limitations and standards, control of toxic pollutants, and monitoring of effluent to ensure limits are not exceeded.	Applicable if remediation includes wastewater discharge; also applies to storm water runoff associated with industrial activities. Effluent limitations established by EPA are included in NDPES permit.	SW-3, SW-4, SW-7, SW-9, SS-3, SS-4, SS-10
NPDES Criteria and Standards	40 CFR 125.104	Best management practices program shall be developed in accordance with good engineering practices.		
Discharge of Oil	40 CFR Part 110	Prohibits discharge of oil that violates applicable water quality standards or causes a sheen of oil on water surface. Runoff from site will need control for oily water discharge to waters of the United States.	Applicable if oily waste is discharged or caused to run off during remedial action.	All
Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RCRA)	40 U.S.C. 6901 et seq.	Establishes the basic framework for federal regulation of solid waste. Subpart C of RCRA control the generation, transportation, treatment, storage, and disposal of hazardous waste through a comprehensive "cradle to grave" system of hazardous waste management techniques and requirements.	Hazardous waste generated by site remediation activities must meet RCRA generator and treatment, storage, or disposal (TSD) substantive requirements. Applicable if hazardous waste is generated during remediation.	

Table 1. Potential Federal ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Identification and Listing of Hazardous Waste	40 CFR Part 261 [WAC 173-303-016]	Identifies by both listing and characterization, those solid wastes subject to regulation as hazardous wastes under Parts 261-265, 268, 270, 271, and 124	Applicable if remediation techniques result in generation of hazardous wastes. Environmental media (e.g. soil and groundwater) contaminated with RCRA listed waste must be managed as RCRA listed waste unless the regulatory agencies determine that the media no longer contains the listed waste.	SW-4, SW-9, SS-4, SS-8, SS-10
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262 [WAC 173-303]	Describes regulatory requirements imposed on generators of hazardous wastes who treat, store, or dispose of the waste onsite.	Applicable if remediation techniques result in generation of hazardous waste.	All
Designation & Determination of LDR Status	40 CFR 262.11 (WAC 173-303-070)	Requires generator to determine waste designation and LDR Status.	Applicable if remediation techniques result in generation of solid waste.	All
Accumulation Time	40 CFR 262.34 [WAC 173-303-200]	Allows a generator to accumulate hazardous waste onsite for 90 days or less without a permit, provided that all waste is containerized and labeled.	Hazardous waste removed from the 100-Area operable units, and waste treatment residues, are subject to the 90-day generator accumulation requirements if the waste is stored onsite for 90 days or less. If hazardous waste is stored onsite for more than 90 days, the substantive provisions of permitting standards for TSD facilities are applicable.	SW-4, SW-9, SS4, SS-8, SS-10
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264 [WAC 173-303]	Establishes requirements for operating hazardous waste treatment, storage, and disposal facilities. Applies to facilities put in operation since November 19, 1980. Facilities in operation before that date and existing facilities handling newly regulated wastes must meet similar requirements in 40 CFR Part 265.	Applicable if remediation technique results in onsite treatment, storage, or disposal of hazardous waste.	SS-8A, SS-8B, SW-9, SS-10
Closure	40 CFR 264.111-264.116[WAC 173-303-610] Subpart G	Performance standard which controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of chemicals. disposal or decontamination of equipment, structures, soils. All contaminated equipment, structures, and soils must be properly disposed.	Substantive requirements may be relevant and appropriate during remediation activities.	SW-9, SS-8, SS-10
Postclosure	40 CFR 264,117-264.120[WAC 173-303-610] Subpart G	Postclosure care must begin after completion of closure and continue for 30 years. During this period, the owner or operator must comply with all postclosure requirements, including maintenance of cover, leachate monitoring, and groundwater monitoring.	Applicable to waste remaining in place after closure. Requires postclosure care and monitoring to ensure elimination of escape of hazardous constituents, leachate, and contaminated runoff.	SW-9, SS-8, SS-10

Table 1. Potential Federal ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Container Storage	40 CFR 264.170-264-178[WAC 173-303-160-173-303-161] Subpart I	Condition of containers, compatibility of waste with containers, container management, containment, special requirements for ignitable or reactive wastes.	May be applicable if container storage is to occur. Inspection requirements may be in potential conflict with ALARA requirements.	SW-4, SW-9, SS-4, SS-8, SS-10
Miscellaneous Unit	40 CFR 264.600-603 (WAC 173-303-680) Subpart X	Requires general environmental performance standards for operations including monitoring and inspections.	may be applicable if miscellaneous units occur, i.e., thermal treatment is used.	SS-10, SW-9
Waste Piles	40 CFR 264.250-259 (WAC 173-303-660) Subpart L	Design in operating requirements: monitoring, leachate system and lines.	May be applicable if waste piles occur outside area of contamination.	All
Tanks	40 CFR 264.190-199 (WAC 173-303-640) Subpart J	Design operating standards for tanks including secondary containment and leak detection systems; tank management; containment; special requirements for ignitable or reactive wastes.	May be applicable if tank storage is to occur. Inspection requirements may be potential conflict with ALARA requirements. May be applicable for soil washing process.	SS-10, SW-9
Temporary Units	40 CFR 264-553 (WAC 173-3-3-646(7)	Establishes alternative performance standards for temporary tanks and containers used for treatment or storage of hazardous remediation wastes for up to one year.	Applicable if temporary unit is used.	SS-10, SW-9
Land Disposal Restrictions (LDR)	40 CFR Part 268 [WAC 173-303-140-WAC 173-303-141]	Generally prohibits placement of restricted RCRA hazardous wastes in land-based units such as landfills, surface impoundments, and waste piles.	Applicable unless waste has been treated, treatment has been waived, a treatment variance has been set for the waste, an equivalent treatment method has been established, or waste qualifies for delisting.	All
Dilution Prohibition	40 CFR 268.3 Subpart A	Requires remediation waste to be appropriately treated which does not include dilution. Generators are required to identify applicable treatment standards at the point of generation and prior to mixing with other remediation wastes.	Applicable waste contains RCRA hazardous constituents.	All
Debris Rule	40 CFR 268.45	Requires treatment of hazardous waste debris by specified technologies contained in 40 CFR 268.45, Table 1.	Applicable if waste contains RCRA hazardous constituents.	All
Prohibition and Treatment Standards	40 CFR 268.30-268.46[WAC 173-303-140]	Establishes treatment standards that must be met prior to land disposal.	Applicable if wastes contain RCRA hazardous constituents.	SW-4, SW-9, SS-4, SS-10
Prohibition on Storage	40 CFR 268.50 [WAC 173-303-141]	The storage of nonradioactive hazardous waste restricted from land disposal under RCRA Section 3004 and 40 CFR 268, Subpart C, is prohibited unless wastes are stored in tanks and containers by a generator or the onsite operator of a TSD facility solely for the purpose of accumulation of such quantities as to facilitate proper treatment or disposal. TSD facility operators may store wastes for up to one year under these circumstances.	Applicable only to nonradioactive hazardous waste.	SW-4, SW-9, SS-4, SS-10

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Table 2. Potential State ARARs.

Chemical Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Model Toxics Control Act (MTCA)	70.105D RCW	Requires remedial actions to attain a degree of cleanup protective of human health and the environment.		
Cleanup Regulations	WAC 173-340	Establishes cleanup levels and prescribes methods to calculate cleanup levels for soils, groundwater, surface water, and air.		
Soil Cleanup Standards	WAC 173-340-700-760	Establishes cleanup standards for contaminated media. These levels must be protective of the groundwater if groundwater is considered a pathway of exposure.	Applicable to remediation actions where hazardous substances have been released. Levels will be calculated based on final land use decision.	All
Radiation Protection–Air Emissions	WAC 246-247	Establishes procedures for monitoring and control of airborne radionuclide emissions.		
New and Modified Sources	WAC 246-247-070	Requires the use of best available radionuclide control technology (BARCT)	If airborne radionuclide omissions are anticipated during remediation at waste sites, emissions must be monitored and control technology developed during design phase.	All

Table 2. Potential State ARARs.

Location Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Habitat Buffer Zone for Bald Eagle Rules	RCW 77.12.655			
Bald Eagle Protection Rules	WAC 232-12-292	Prescribes action to protect bald eagle habitat, such as nesting or roost sites, through the development of a site management plan.	Applicable if the areas of remedial activities includes bald eagle habitat.	All
The Indian Graves and Records Act of the State of Washington	RCW 27.44	Prohibits the willful removal, mutilation, defacement, or destruction of any cairn, grave, or glyptic or painted record of any Native Indian or prehistoric people. Requires agency to consult with traditional religious leaders regarding activities that might affect religious sites.	There are Native American burial grounds and cultural areas within the 100 Area Operable Units; therefore, this is applicable.	All
Department of Game State Environmental Policy Act	WAC 232-012	Requires management plans if endangered, or sensitive wildlife or habitat are affected. Washington State Department of Fish and Wildlife will be consulted to minimize ecological impacts.	Upon the determination of impacts to threatened, endangered, or sensitive species or habitat by the remedial actions, this may be applicable.	All

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Table 2. Potential State ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Department of Ecology	43.12A RCW	Vests the Washington Department of Ecology with the Authority to undertake the state air regulation and management program.		
Air Pollution Regulations	WAC 173-400	Establishes requirements for the control and/or prevention of the emission of air contaminants.		
Standards for Maximum Emissions	WAC 173-400-040	Requires best available control technology be used to control fugitive emissions of dust from materials handling, construction, demolition, or any other activities that are sources of fugitive emissions. Restricts emitted particulates from being deposited beyond Hanford. Requires control of odors emitted from the source. Prohibits masking or concealing prohibited emissions. Requires measures to prevent fugitive dust from becoming airborne.	Applicable to dust emissions from cutting of concrete and metal and vehicular traffic during remediation.	SW-3, SW-4, SW-7, SW-9, SS-3, SS-4, SS-8, SS-10
Emission Limits for Radionuclides	WAC 173-480	Controls air emissions of radionuclides from specific sources.	Applicable to remedial activities that result in air emissions.	
New and Modified Emission Units	WAC 173-480-060	Requires the best available radionuclide control technology be utilized in planning constructing, installing, or establishing a new emissions unit.	Applicable to remedial actions that result in air emissions.	SW-4, SW-7, SW-9, SS-4, SS-8, SS-10
Washington Clean Air Act	RCW 70.94			
Controls for New Sources of Toxic Air Pollutants	WAC 173-460	Establishes systematic control of new sources emitting toxic air pollutants.		
Decontaminating Ambient Impact Compliance	WAC 173-460-080	Requires the owner or operator of a new source to complete an acceptable source impact level analysis using dispersion modeling to estimate maximum incremental ambient impact of each Class A or B toxic air pollutant. Establishes numerical limits for small quantity emission rates.	Applicable to remedial alternatives with the potential to release toxic air pollutants.	SW-4, SW-7, SW-9, SS-4, SS-8, SS-10
Hazardous Waste Management Act of 1976 as amended in 1980 and 1983	70.105 RCW	Establishes a statewide framework for the planning, regulation, control, and management of hazardous waste.		
Dangerous Waste Regulations	WAC 173-303	Establishes the design, operation, and monitoring requirements for management of hazardous waste. Includes requirements for generators of dangerous waste. Dangerous waste includes the full universe of wastes regulated by WAC 173-303 including extremely hazardous waste.	Applicable if dangerous or extremely hazardous waste is generated and/or managed during remedial action.	All

Table 2. Potential State ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Waste Designation	WAC 173-303-070, 071, 080, 082, 090, 100, 110	Exceeds federal RCRA program by requiring designation of waste including additional parameters; i.e., toxicity, persistence, and carcinogenicity -- additional listed wastes, PCBs.	Applicable if remediation wastes, based on process knowledge/analysis exceed the parameters.	All
Land Disposal Restrictions	WAC 173-303-140	State LDR requirements exceed the federal requirements for nonradiological extremely hazardous, organic/carbonaceous and solid acid wastes.	Applicable if remediation wastes meet additional categories.	All
Model Toxics Control Act	70.105D RCW	Authorizes the state to investigate releases of hazardous substances, conduct remedial actions, carry out state programs authorized by federal cleanup laws, and take other actions		
Hazardous Waste Cleanup Regulations	WAC 173-340	Addresses releases of hazardous substances caused by past activities, and potential and ongoing releases from current activities.	Applicable to facilities where hazardous substances have been released, or there is a threatened release that may pose a threat to human health or the environment.	All
Selection of Cleanup Actions	WAC 173-340-360(4)	Establishes hierarchy of consideration before selecting cleanup process.	Must be considered during comparative analysis of remedial alternatives.	All
Cleanup Actions	WAC 173-340-400	Ensures that the cleanup action is designed, constructed, and operated in accordance with the cleanup plan and other specified requirements.	Cleanup must follow remedial design document and remedial action work plans.	All
Institutional Controls	WAC 173-340-440	Requires physical measures such as fences and signs to limit interference with cleanup.	Physical measures may be applicable if institutional controls are used.	SW-2, SW-3, SW-4, SW-7, SW-9, SS-2, SS-3, SS-4, SS-8, S-10
Solid Waste Management Act	70.95 RCW	Establishes a statewide program for solid waste handling, recovery, and/or recycling.		
Minimum Functional Standards for Solid Waste Handling	WAC 173-304	Establishes requirements to be met statewide for the handling of all solid waste.	Applicable if management of solid waste occurs during remediation. Solid waste controlled by this Act includes garbage, industrial waste, construction waste, ashes, and swill.	All
Onsite Containerized Storage, Collection, and Transportation Standards	WAC 173-304-200	Sets requirements for containers and vehicles to be used on site.	Applicable if containers are used during remediation.	All
Water Pollution Control Act	90.48 RCW	Prohibits discharge of polluting matter in waters.		
State Waste Discharge Permit Program	WAC 173-216	Requires the use of all known available, and reasonable methods of prevention, control and treatment.	Applicable for any discharges of liquids to the ground.	All

Table 2. Potential State ARARs.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Water Well Construction Act	18.104 RCW			
Standards for Construction and Maintenance of Wells	WAC 173-160	Establishes minimum standards for design, construction, capping, and sealing of all wells; sets additional requirements including disinfection of equipment, abandonment of wells, and quality of drilling water.	Applicable if water supply wells, monitoring wells, or other wells are utilized during remediation.	SW-2, SW-3, SW-7, SS-2, SS-3, SS-8

Table 3. Potential To Be Considered Requirements.

Chemical Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Benton Clean Air Authority	Regulation 1	Establishes regulations relative to asbestos		All
U.S. Department of Energy Orders				
Radiation Protection of the Public and the Environment	DOE 5400.5	Establishes radiation protection standards for the public and environment.	This Order will be replaced with 10 CFR 834 when it is promulgated.	
Radiation Dose Limit (All Pathways)	DOE 5400.5, Chapter II, Section 1a	The exposure of the public to radiation sources as a consequence of all routine DOE activities shall not cause, in a year, an effective dose equivalent greater than 100 mrem from all exposure pathways, except under specified circumstances.	If remedial activities are considered "routine DOE activities," this order would be relevant and appropriate.	All

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Table 3. Potential To Be Considered Requirements.

Chemical Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Residual Radionuclides in Soil	DOE 5400.5 Chapter IV, Section 4a	Guidelines for residual concentrations of radionuclides other than Radium-226 must be derived from the basic dose limits by means of an environmental pathway analysis using specific property data where available. Procedures for these deviations are given in "A Manual for Implementing Residual Radioactive material Guidelines" (DOE/CH-8901). In addition, residuals must also meet "authorized" limits which may (and undoubtedly will) be lower than the concentrations derived form the basic dose limits. (DOE 5400.5 IV, Section 5.) Procedures for determination of "hot spots," "hot-spot cleanup limits," and residual concentration guidelines for mixtures are in DOE/CH-8901. Residual radioactive materials above the guidelines must be controlled to the required levels in 5400.5, Chapter II and Chapter IV.	Residual concentrations of radioactive material in soil are defined as those in excess of background concentrations averaged over an area of 100 m^2. This order must be considered for residual radionuclides in soils, dependent upon land use decision.	All
NRC Draft Radiological Criteria for Decommissioning	10 CFR Part 20 (proposed revision)	The intent of this rulemaking is to provide a clear and consistent regulatory basis for determining the extent to which lands and structures must be remediated before a site can be considered decommissioned. The primary goal is to return the site to levels approximately background. Indistinguishable from background is defined as no more than 3 mrem per year over background. The limit would be 15 mrem/year over background.	This will be applicable upon promulgation.	All
Radioactive Waste Management	DOE Order 5820.2A	Defines waste designation for TRU, high and low level waste and establishes generator criteria.	This DOE Order is being extensively revised as 5820.2B	All
Draft Department of Energy Radiation Protection of the Public and the Environment	10 CFR 834	Additional requirements above 5400.5 that are more prescriptive.	Will replace 5400.5.	All

Table 3. Potential To Be Considered Requirements.

Location Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Hanford Reach Study Act	P.L. 100-605	Provides for a comprehensive river conservation study. Prohibits the construction of any dam, channel, or navigation project by a federal agency for 8 years after enactment. New federal and nonfederal projects and activities are required, to the extent practicable, to minimize direct and adverse effects on the values for which the river is under study and to utilize existing structures.	This law was enacted November 4, 1988.	All
Wild and Scenic Rivers Act	16 U.S.C. 1271	Prohibits federal agencies from recommending authorization of any water resource project that would have a direct and adverse effect on the values for which a river was designated as a wild and scenic river or included as a study area.	The Hanford Reach of the Columbia River is under study for inclusion as a wild and scenic river.	SW-3, SW-4, SW-7, SW-9, SS-3, SS-4, SS-8, SS-10.

Table 3. Potential To Be Considered Requirements.

Action Specific

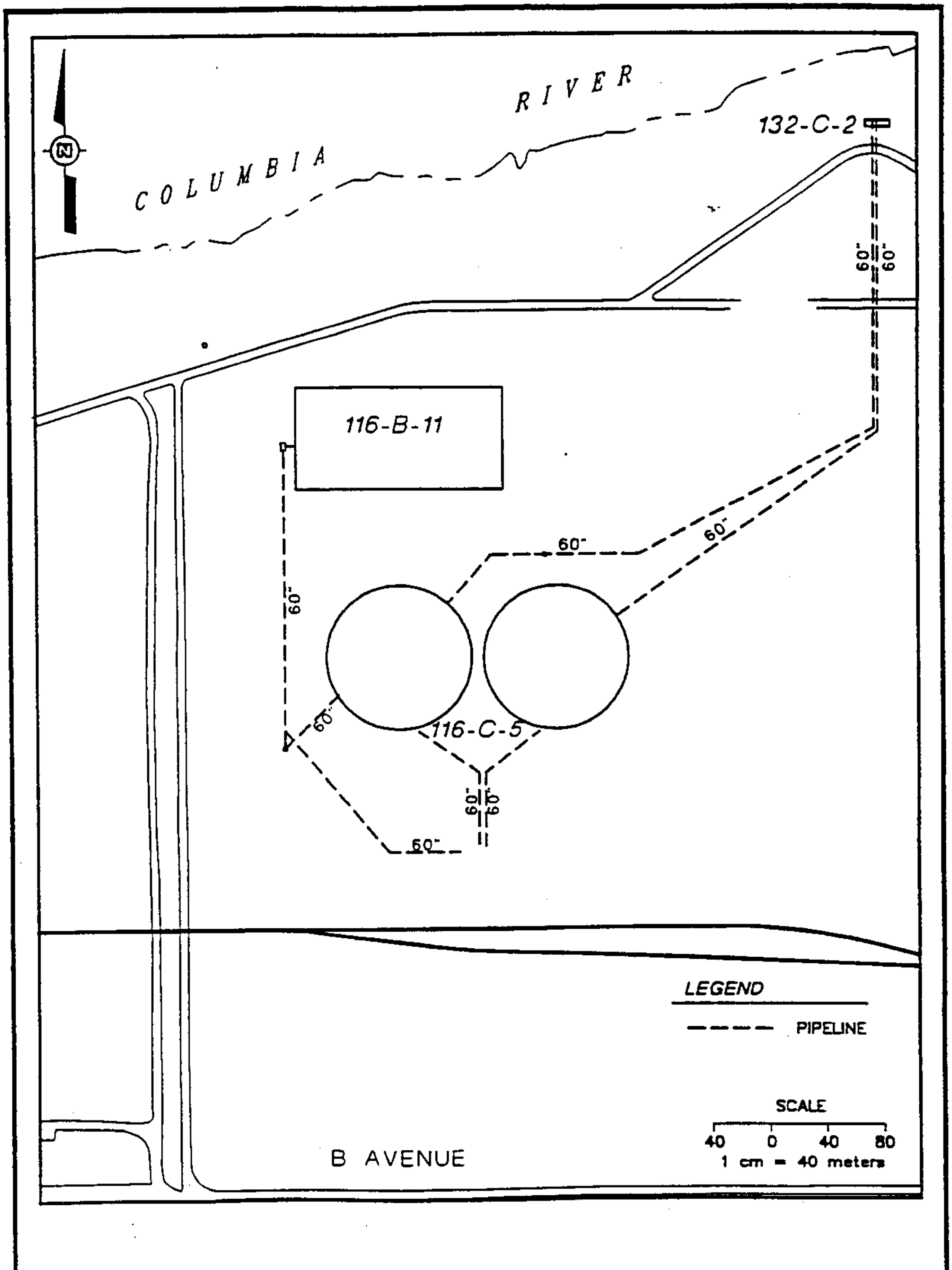
Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Benton Clean Air Authority		Establishes a regional program for open burning.	These county regulations are authorized by the state Clean Air Act.	All
Residual Radioactive Material as Surface Contamination	U.S. NRC Regulatory Guide 1.86	Sets contamination guidelines for release of equipment and building components for unrestricted use, and if buildings are demolished, shall not be exceeded for contamination in the ground	Dependent upon land use decisions, this guide may be considered.	D&D Facilities
Fish and Wildlife Coordination Act	16 U.S.C. 661 et seq.	This Act ensures that wildlife conservation is given equal consideration with other values during the planning of activities that affect water resources. The Act authorizes the Secretary of the Interior to provide assistance to federal, state, and public or private agencies in the "development, protection, rearing, and stocking of all species of wildlife, resources thereof, and their habitat...". The Act also requires a consultation with the U.S. Fish and Wildlife Service (USFWS) when a federal agency plans to impound, or deepen, or otherwise modify a body of water.	While the recommendations by the USFWS are not legally binding, DOE is required to give them full consideration.	All
Executive Orders Protection of Wetlands	EO 11990	This Executive Order requires that each federal agency "...take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for 1) acquiring, managing, and disposing of Federal lands and facilities; and 2) providing Federally undertaken, finance, or assisted construction and improvements; and 3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities."	Must be considered if action is taken that may impact wetland area.	All
Floodplain Management	EO 11988	This Order requires federal agencies to take floodplain management into account when formulating or evaluating water or land use plans. The Order specifies that "...each agency shall...restore and reserve the natural and beneficial values served by floodplains in carrying out its responsibilities for 1) acquiring, managing, and disposing of Federal lands and facilities; 2) providing Federally undertaken, financial, or assisted construction and improvements; and 3) conducting Federal activities and programs affecting land use.	Must be considered if actions are taken within a flood plain.	All
Protection and Enhancement of the Cultural Environment	EO 11593	Provides direction to federal agencies to preserve, restore, and maintain cultural resources.	Pertains to sites, structures, and objects of historical, archeological, or architectural significance.	All

Table 3. Potential To Be Considered Requirements.

Action Specific

Description	Citation	Requirements	Remarks	Alternatives Potentially Affected
Exotic Organisms	EO 11987	This Order requires Federal agencies to restrict, to the extent possible, the introduction of exotic species into the lands or waters that they own, lease, or hold for purposes of administration. It also restricts the use of Federal funds and programs for importation and introduction of exotic species.		All
U.S. Department of Energy Orders				
Discharge of Treatment System Effluent	DOE 5400.xy	Treatment systems shall be designed to allow operators to detect and quantify unplanned releases of radionuclides, consistent with the potential for off-property impact.	Required of all DOE-controlled facilities where radionuclides might be released as a consequence of an unplanned event.	SW-7, SW-9, SS-8, SS-10
Safety Requirements for the Packaging of Fissle and Other Radioactive Materials	DOE 5480.3 Sections 7 and 8	Establishes requirements for packaging and transportation of radioactive materials for DOE facilities.	Requirements must be met if radioactive material is packaged and transported to disposal facility.	SW-4, SW-9, SS-4, SS-10
Radioactive Waste Management	DOE 5820.2A Chapters III and IV	Establishes policies and guidelines by which DOE manages radioactive waste, waste by-products, and radioactive contaminated surplus facilities. Disposal shall be on the site at which it was generated, if practical, or at another DOE facility. DOE waste containing byproduct material shall be stored, stabilized in place, and/or disposed of consistent with the requirements of the residual radioactive material guidelines contained in 40 CFR 192.	Must be met when managing radioactive waste created by remediation activities.	All
Department of Ecology Liquid Effluent Consent Order	DE 91NM-177	Requires discharges of liquid effluent to the soil column to be eliminated, treated, or otherwise minimized.		SW-9, SS-8, SS-10
Tri-Party Agreement		Establishes requirements, guidelines, and schedules for the environmental restoration program at the Hanford Site.	Must be adhered to and complied with by all parties with regard to remedial actions at all operable units.	All

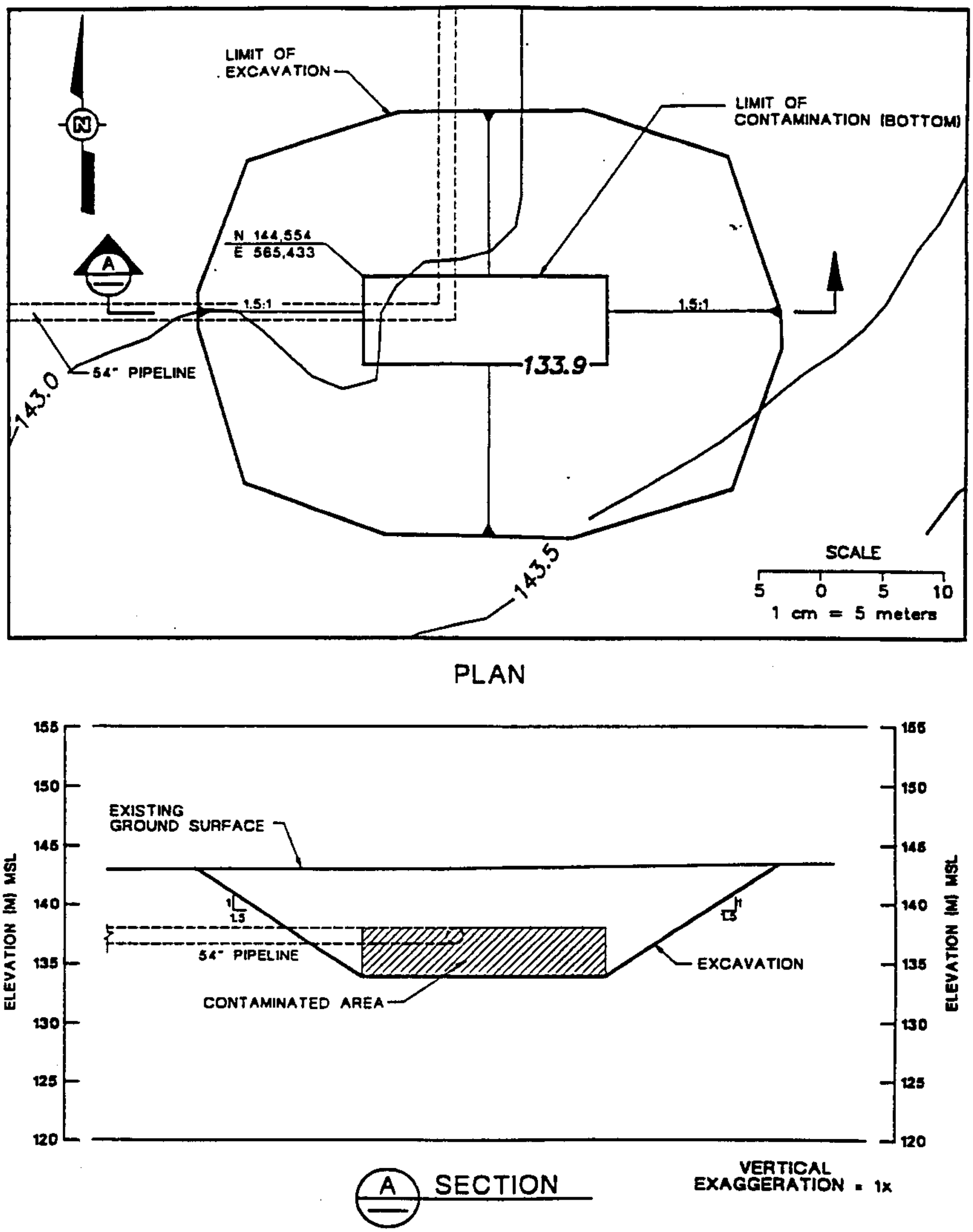
Figure A-21 100 B/C 60 inch Pipelines



PLN60

Figure 21. 100 B/C 60 inch Pipelines.

Figure A-20 100 B/C Junction Box Leak



EXTENT OF CONTAMINATION

SURFACE AREA = 144 sq. meters
VOLUME = 665 cu. meters

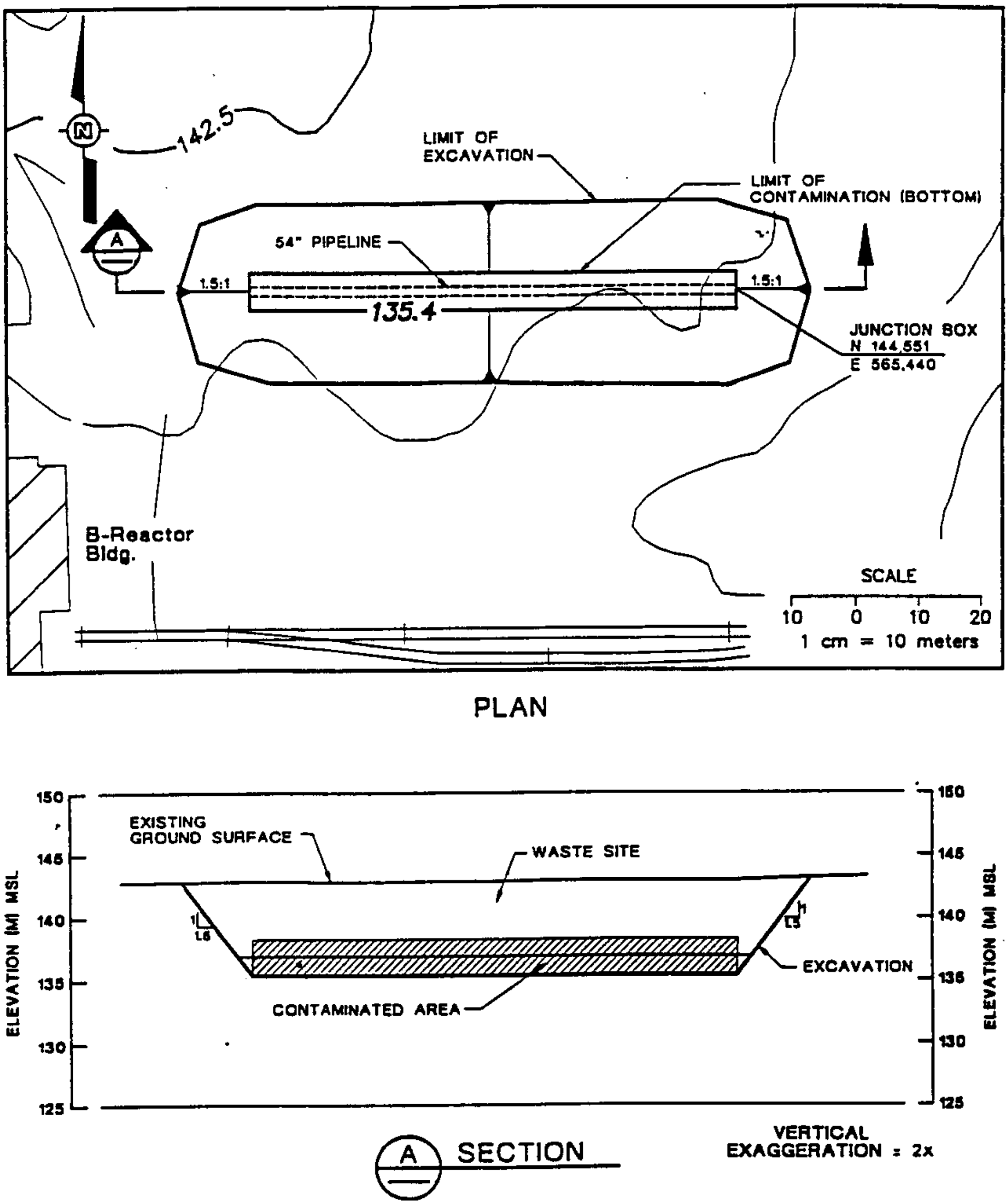
EXTENT OF EXCAVATION

SURFACE AREA = 1,413 sq. meters
VOLUME = 6,358 cu. meters

54JUNC

Figure 20. 100 B/C Junction Box Leak.

Figure A-19 100 B/C 54 inch Pipeline at Junction Box Leak



EXTENT OF CONTAMINATION

SURFACE AREA = 441 sq. meters
VOLUME = 1,325 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 2,637 sq. meters
VOLUME = 11,117 cu. meters

54LEAK

Figure 19. 100 B/C 54 inch Pipeline at Junction Box Leak.

Figure A-18 100 B/C 54 inch Pipelines

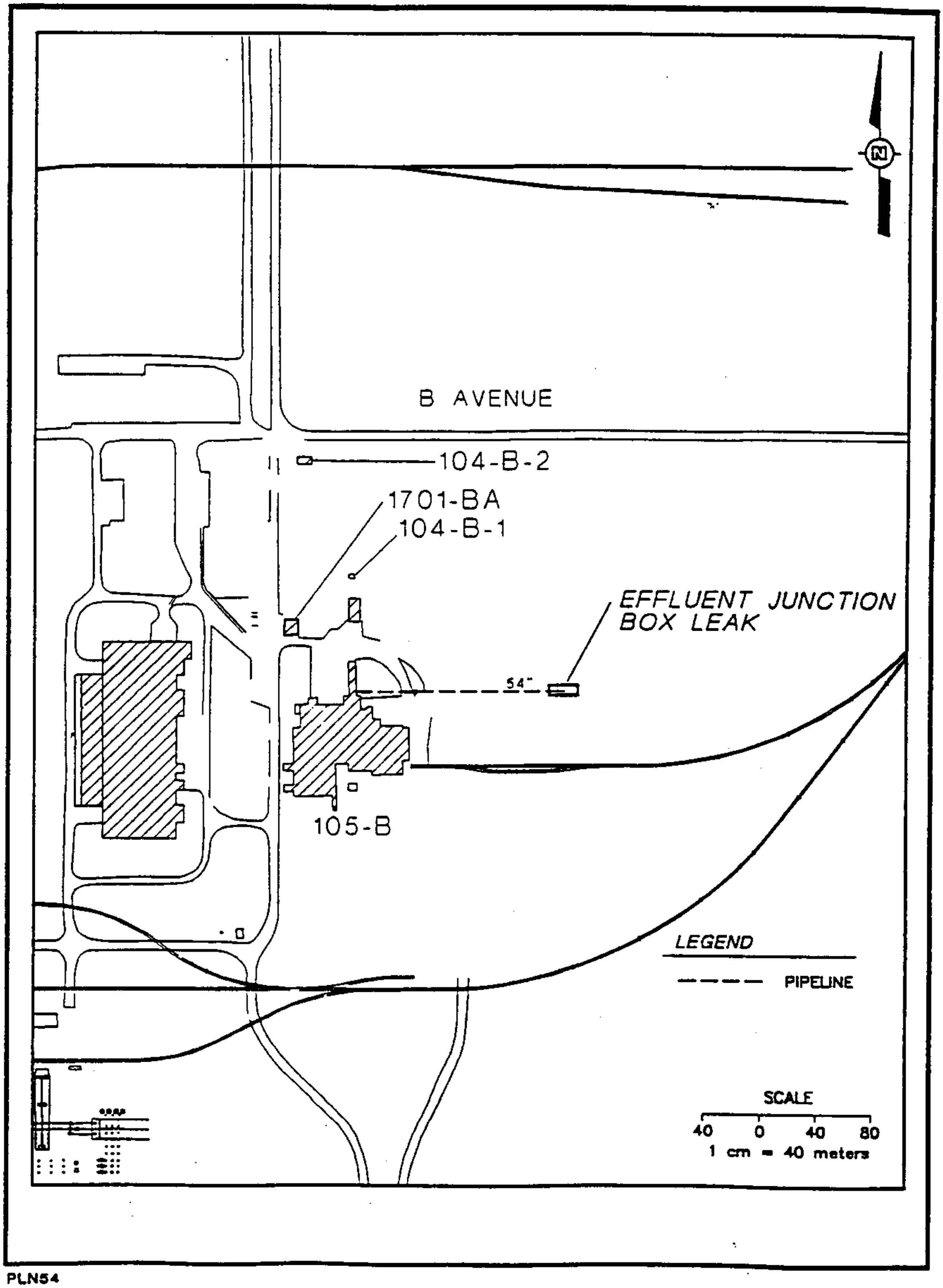
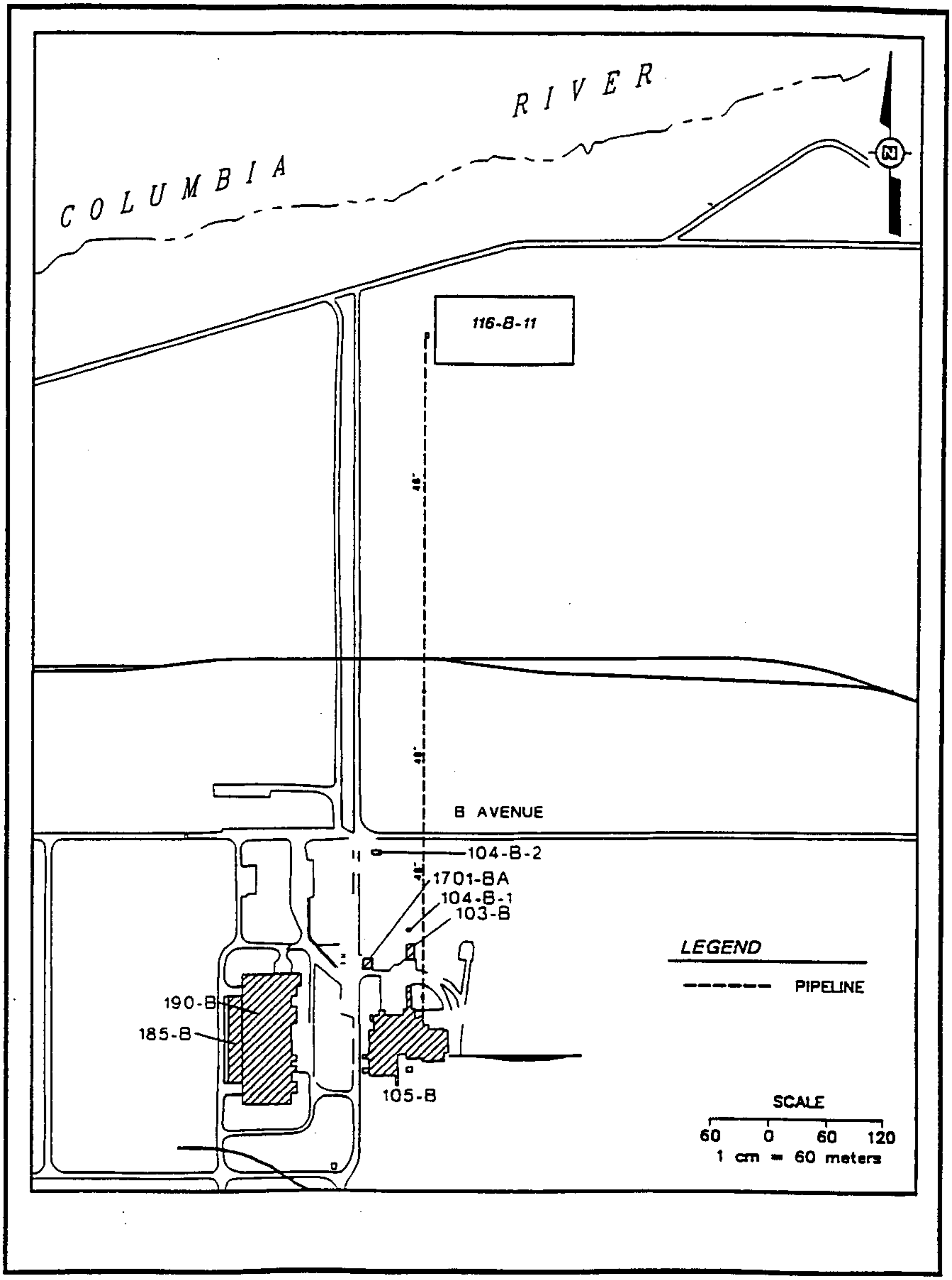


Figure 18. 100 B/C 54 inch Pipelines.

Figure A-17 100 B/C 48 inch Pipelines



PLN48

Figure 17. 100 B/C 48 inch Pipelines.

APPENDIX F

100-BC-1 OPERABLE UNIT FOCUSED FEASIBILITY STUDY REPORT

ACRONYMS

ARAR	applicable or relevant and appropriate requirements
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC	contaminants of potential concern
D&D	decontamination and decommissioning
EPA	U.S. Environmental Protection Agency
FFS	focused feasibility study
IRM	interim remedial measures
LFI	limited field investigation
PRG	preliminary remediation goals
QRA	qualitative risk assessment

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

FIGURES

TABLES

CONTENTS (continued)

TABLES (continued)

CONTENTS (continued)

TABLES (continued)

1.0 INTRODUCTION

The objective of this operable unit-specific FFS is to provide decision makers with sufficient information to allow appropriate and timely selection of interim remedial measures for sites associated with the 100-HR-1 Operable Unit. As discussed in the main text, certain inherent assumptions are required in order to establish "appropriately and timely" interim remedial measures. The assumptions and qualifiers outlined in the main text have been followed in the work being performed in this appendix. The plug-in approach can be utilized since this appendix is based on the same land use and groundwater use scenario as utilized in the process document. The sensitivity analysis is then used as a basis to discuss changes to the detailed investigation due to other land use and/or groundwater use scenarios.

The Process Document and this operable unit-specific FFS are based on an exposure scenario that included occasional use of the land and frequent use of the groundwater. The sensitivity analysis (Appendix D) has been developed to show the impacts of additional exposure scenarios.

The interim remedial measure candidate waste sites are determined in the limited field investigation (DOE-RL 1993b). Site profiles are developed for each waste site. The site profiles are used in the application of the plug-in approach. The waste site either plugs into the analysis of the alternatives for the group, or deviations from the developed group alternatives are described and documented. A summary of the focused feasibility study results for the 100-BC-1 interim remedial measures candidate waste sites is as follows:

- Waste sites require no additional alternative development.
- Sites that directly plug into the waste site group alternative include 116-B-11, 116-B-1, 116-C-1, 116-B-13, 116-B-14, 116-B-4, 116-B-12, 118-B-5, 118-B-7, 118-B-10, 132-B-4, 132-B-5, and the pipelines. The site-specific detailed analysis was conducted, and reference the waste site group analysis as appropriate.
- Waste site 116-B-5 is considered a special crib due to its unique waste stream. Therefore, this waste site must be addressed individually because no group profile was developed. However, it is apparent that the 116-B-5 alternatives are consistent with the dummy decontamination crib/french drain group.
- Retention basin 116-C-5 contains organic contamination and therefore will deviate from the waste group by the addition of a thermal desorption treatment unit.
- Outfall structures 116-B-7, 132-B-6, and 132-C-2 have recently been designated as an expedited response action and will be addressed concurrently with the river pipelines.

- Decontamination and decommissioning facilities 132-B-4 and 132-B-5 were remediated before the development of the remedial investigation/feasibility study. These sites were therefore considered no action sites.

- A comparative analysis of remedial alternatives is presented for each waste site.

1.1 PURPOSE AND SCOPE

The scope of this report (BC-1 appendix) is limited to 100-BC-1 Operable Unit interim remedial measure (IRM) candidate waste sites as determined in the limited field investigation (LFI) report (DOE-RL 1993b). Impacted groundwater beneath the 100 Area is being addressed in a separate focused feasibility study (FFS) report for the 100-BC-5 Operable Unit. In addition, waste sites that are not considered candidates for IRM, accordingly, are being addressed under the remedial investigation/feasibility study (RI/FS) pathway of the *Hanford Past Practice Strategy* (DOE-RL 1991). The decision to limit the scope of this DR-1 appendix is documented and justified in the applicable work plans, LFI, qualitative risk assessments (QRA), and the *100 Area Feasibility Study Phases 1 and 2* (DOE-RL 1993a).

This report presents the following:

- The 100-BC-1 Operable Unit individual waste site information (Section 2.0)

- The development of individual waste site profiles (Section 2.0)

- The identification of representative groups for individual waste sites and a comparison against the applicability criteria and enhancements for the alternatives (Section 3.0)

- A discussion of the deviations and/or enhancements of an alternative and additional alternative development, as needed (Section 4.0)

- The detailed analysis of alternatives for sites that deviate from the representative group alternatives (Section 5.0)

- The comparative analysis for all individual waste sites using the process document baseline scenario (Section 6.0)

- A discussion of the modifications and associated comparative analysis to the baseline scenario due to the results of the sensitivity analysis (Section 7.0)

1.2 INCORPORATION OF NATIONAL ENVIRONMENTAL POLICY ACT VALUES

In accordance with DOE Order 5400.4 and Chapter 10 of the *Code of Federal Regulations* (CFR) Part 1021, the considerations (values) of the *National Environmental Policy Act of 1969* (NEPA) must be incorporated in the CERCLA process. The NEPA considerations are incorporated in the Process Document (Section 3.3).

The NEPA values, such as description of the affected environment (including meteorology, hydrology, geology, ecological resources, and land use), applicable laws and guidelines, short-term and long-term impacts on human health and the environment, and cost are included to a limited degree within a typical CERCLA feasibility study. Other NEPA values not normally addressed in CERCLA feasibility study, such as socio-economic impacts, cultural resources, and transportation impacts, have been evaluated in the Process Document.

The NEPA impacts that are specific to the 100-HR-1 Operable Unit are discussed in Section 2.2 and detailed analysis of alternatives are addressed in Section 5.0 of this document.

2.0 WASTE SITE INFORMATION

2.1 OPERABLE UNIT BACKGROUND

The 100-BC-1 Operable Unit is located in the north-central part of the Hanford Site along the southern shoreline of the Columbia River. The operable unit is about 45 km (28 mi) northwest of the city of Richland and encompasses about 1.8 km^2 (0.7 mi^2). It lies predominantly within Section 11.0, the southern portion of Section 2.0, and the western portion of Section 12.0 of Township 13N, Range 25E. It is bound by North American Datum 1983 metric Washington State plane north/south coordinates N144300 and N145650 and east/west coordinates E564500 and E566680.

The 100-BC-1 Operable Unit is one of three operable units associated with the 100 B/C Area at the Hanford Site. Two of the 100 B/C Area operable units are source operable units and one is a groundwater operable unit. The 100-BC-1 Operable Unit generally includes liquid and sludge disposal waste sites associated with operation of the B Reactor (Figure 2-1). The 100-BC-2 Operable Unit includes the C Reactor and its associated facilities, the burial grounds south of the C Reactor, and the solid waste facilities northeast of B Reactor. The 100-BC-5 Operable Unit includes the groundwater below the source operable unit plus the adjacent groundwater, surface water, sediments, and aquatic biota impacted by the 100 B/C Area operations.

Since the preparation of the *100 Area Feasibility Study Phases 1 and 2* (DOE-RL 1993a), additional data has been collected that is relevant to the 100 Area in general, and specifically relevant to the 100-BC-1 Operable Unit. A LFI and QRA were performed for the 100-BC-1 Operable Unit (DOE-RL 1993e and WHC 1993, respectively). The LFI also assumes that burial grounds and sites that have been contaminated and decommissioned are IRM candidate sites regardless of the above criteria. The results of the IRM candidacy evaluation are presented in Table 2-1. Outfall structures 116-B-7, 132-B-6, and 132-C-2 are currently scheduled for an expedited response action (ERA), and are therefore not addressed further in this FFS. The conclusions drawn during the LFI assessment were used solely to determine IRM candidacy for high priority sites within the 100-BC-1 Operable Unit. This FFS relies on the data presented in the LFI/QRA. Assessments, evaluations, and conclusions drawn by this FFS are based on the methodology described in the Process Document. In addition, aggregate area management studies were performed to evaluate cultural resources and area ecology.

Table 2-1 identifies waste sites 116-B-9 and 116-B-10. A summary of site background and ecological information are presented in Section 2.0 of the Process Document. The cultural resources of 100-BC-1 are discussed below.

Cultural Resources. The Hanford Cultural Resources Laboratory conducted an archaeological survey during fiscal year 1991 for 100 Area Reactor compounds (Chatters et al. 1992). A summary of Hanford Site cultural resources can be found in Cushing (1994). The following is an excerpt from Cushing (1994) concerning the 100-B and 100-C areas.

"The 100-B Reactor is listed as a National Historic Civil Engineering Landmark and is listed on the National Register of Historic Places. Additional buildings from the Manhattan Project and early Cold War era stand in this area. Historic and prehistoric archaeological resources exist in the vicinity of 100-B and 100-C areas, at least on the basis of the level of reconnaissance that has been done there. Only three sites can be identified from area literature (Rice 1968a, 1980). All lie partially within the 100-B and 100-C areas. A fourth archaeological site and the remains of the early 20th-century town of Haven lie on the opposite bank of the Columbia River. The archaeological site appears to contain artifact deposits about 3500-2500 years old but has not been tested. One archaeological site near 100B/C (45BN446) was evaluated in 1994 and the state historic preservation officer has determined that it is eligible for listing on the National Register. The other two sites have not been tested to determine National Register eligibility. Numerous sites related to hunting and religious activities are located at the west end of Gable Butte, due south of the 100-B and 100-C Areas. These sites are part of the proposed Gable Mountain/Gable Butte Traditional Cultural Property nomination. Test excavations conducted in 1991 at one hunting site in Gable Butte revealed large quantities of deer and mountain sheep bone and projectile points dating from 500 to 1,500 years old."

2.1.1 Site Descriptions

To aid in the identification of the appropriate waste site group, the original physical and functional characteristics of each IRM candidate site have been developed. These characteristics include site name, functional use, and physical description.

Site Name - The site name is the initial indicator of the appropriate group.

Functional Use - Functional use of the waste site is an important characteristic in determining waste site groupings. For example, if it is known that a site was used for transport of liquid wastes, using Figure 1-4 of the Process Document, it is possible to eliminate many potential groups.

Physical Description - This element defines the physical characteristics of a waste site by identifying size and structure. These characteristics are valuable to evaluating extent of contamination, as well as identifying media/material.

Descriptions of each IRM candidate waste site are presented in Table 2-2.

2.1.2 Refined Contaminants of Potential Concern

In a manner similar to the method described in Section 2.6 of the Process Document, refined contaminants of potential concern (COPC) have been developed for each IRM candidate waste site. These refined COPC are the result of screening the COPC from the 100-BC-1 QRA (WHC 1993c) against the preliminary remediation goals (PRG) defined in Appendix A. Tables 2-5 through 2-12 present the evaluation of refined COPC for waste sites with site specific data. Waste sites that do not have site-specific data use data from the group site profile for COPC, and therefore no site-specific COPC evaluation table is presented. Burial grounds use process knowledge data from Miller and Wahlen (1987) to determine COPC, and no site specific evaluation tables are presented.

The PRG are developed under a occasional exposure scenario considering risk to human and ecological receptors, compliance with applicable or relevant and appropriate requirements (ARAR), protection of groundwater, local background concentrations, and levels of detection. Of the sources of PRG, the most stringent value is used for screening as long as the value is not below local background and is above levels of detection. Another important aspect of the PRG is that the appropriate value varies with depth. As stated in Section 2.2.2 of Appendix A, humans are receptors in the first 1 m (3 ft) of soil, animals and plants are receptors in Zone 1: 0 to 3 m (0 to 10 ft), and protection of groundwater must be considered throughout the soil column.

The data sources used for the identification of refined COPC include:

- *Limited Field Investigation for the 100-BC-1 Operable Unit* (DOE-RL 1993b)

- *Radiological Characterization of the Retired 100 Areas* (Dorian and Richards, 1978)

These data sources were also used to perform the QRA, and constitute the basic data set for the 100 Area source operable units. The study by Dorian and Richards (1978) was fairly comprehensive with respect to the number of sites investigated; however, only radiological data was taken, and sampling and analysis protocol was not equivalent to the current standards. The LFI data explored only a few sites, but collected data for radionuclides, inorganics, and organics. Sampling and analysis protocols for the LFI data are based on standards presented in the associated work plan (DOE-RL 1992b).

The following criteria were used for the assemblage of data for the identification of the refined COPC.

- The vadose zone was broken down into ranges consistent with the zones accessible by receptors as presented in the Process Document (i.e., Zone 1: 0 to 3 m [0 to 10 ft], and Zone 2: below 3 m [10 ft]).

- Maximum concentrations from the LFI and Dorian and Richards (1978) for each interval were identified, and the historical data was decayed to 1992 for the consistency with the LFI data.

- The highest concentration between the LFI and historical data was recorded for each interval.

- The maximum concentrations were screened against the PRG.

- All constituents that exceed PRG are identified, and those exceeding a PRG in any of the intervals are considered refined COPC for the waste site.

When reviewing the data used for the identification of refined COPC, the following should be considered:

- Tables report only maximum concentrations, therefore it should be noted that the entire data sets as well as the appropriate qualifiers and sampling and analysis protocols are discussed in the data source reports mentioned previously.

- Data reported at an interval break, such as 4.57 m (15 ft) were reported in previous range (i.e., 3.04 to 4.57 m [10 to 15 ft]).

- Data reported which overlaps ranges were recorded in both ranges (i.e., data from 4.47 to 4.88 m [14.5 to 16 ft] is recorded in the 3.04 to 4.57 m [10 to 15 ft] and 4.57 to 6.10 m [15 to 20 ft] ranges).

- The ^{63}Ni reported in Dorian and Richards (1978) may have been analyzed using a surrogate; therefore, the concentrations reported may not be an accurate representation of the actual concentration at the waste site.

- Total-uranium reported in Dorian and Richards (1978) has been recorded as ^{238}U because ^{238}U is the major risk contributor of the uranium isotopes in the QRA.

Any constituent that has a concentration exceeding the appropriate PRG value at any given depth is considered a refined COPC. The screening process results in the identification of all refined COPC, which must be addressed by remedial action at the given IRM candidate waste site.

2.1.3 Waste Site Profiles

Based on data from the 100-BC-1 Operable Unit LFI (DOE-RL 1993c) and the refined COPC discussed in Section 2.4.2, a profile for each IRM candidate waste site was developed. The waste site profiles consist of waste site characteristics such as extent of contamination, contaminated media/material, maximum concentrations of the refined COPC, and a determination of exceedance of allowable soil concentrations under a reduced infiltration scenario. The profiles perform two functions:

1. they contain the information for comparison to the group profiles and alternative criteria defined in the Process Document (Section 4.2); and

2. they aid in development of a data base for determining costs and durations of remedial activities (i.e., contaminated volume impacts cost of disposal and duration of excavation). The profile parameters are defined below, site-specific profiles are detailed in Table 2-13.

    - Extent of Contamination--The values for these parameters are based on volume estimates performed for each site (presented in Attachment 1 of this appendix).

Volume, length, width, and area do not necessarily impact the determination of appropriate remedial alternatives; however, they are important considerations for developing costs and durations of remedial alternatives. Thickness of the contaminated lens impacts the implementability of in situ actions such as vitrification, that has a limited vertical extent of influence.

- Contaminated Media/Material--Structural materials such as steel, concrete, and wooden timbers influence the applicability of remedial alternatives, as well as equipment needed for actions such as removal. Presence of soils and sludges are necessary for implementation of treatment options such as soil washing. Presence of solid waste media impacts material handling considerations and may require remedial alternatives that vary from sites with contaminated soil.

- Refined COPC/Maximum Concentrations--Refined COPC for a site are determined as discussed in Section 2.12 of the Process Document. The associated maximum concentration for that constituent is the highest concentration exceeding PRG detected in any of the IRM candidate waste site data. Refined COPC may influence the applicability of remedial alternatives. For instance, the presence of radioactive contaminants may allow natural decay to be a consideration in determining appropriate remedial alternatives, organic contaminants may require that enhancements such as thermal desorption be added to a treatment system, and the presence of ^{137}Cs influences the effectiveness of treatment alternatives such as soil washing.

- Reduced Infiltration Concentration--The reduced infiltration concentration is a level which is considered protective of groundwater under a scenario where hydraulic infiltration is limited by the application of a surface barrier. The derivation of this concentration is documented in Appendix A. The maximum concentration detected is compared to the allowable reduced infiltration concentration. Exceedance of the reduced infiltration concentrations indicates that impact to groundwater will not be mitigated by containment alternatives such as a barrier.

The profiles for each IRM candidate waste site in the 100-BC-1 Operable Unit are presented in Table 2-13.

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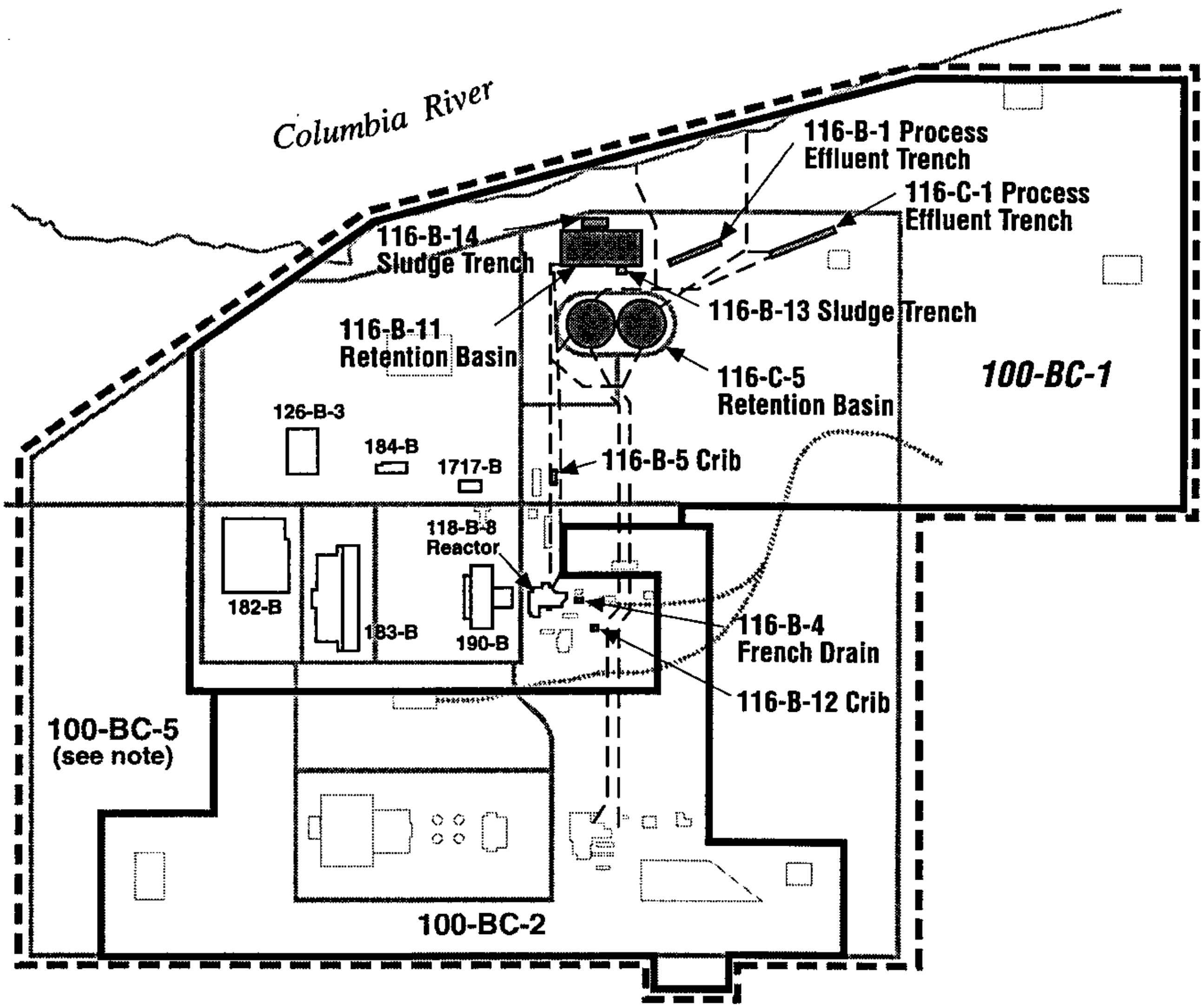
Figure 2-1. 100-BC Operable Unit Map.



100-BC-1 Operable Unit

Legend

Radioactive Liquid Waste Disposal Sites

Other Waste Sites Associated with the 100-BC-1 Operable Unit

Note: The heavy dashed line indicates the preliminary limits of the 100-BC-5 Operable Unit.

E9503017.4

Table 2-1. IRM Recommendations from the 100-BC-1 LFI.

Waste Site	Qualitative Risk Assessment		Conceptual Model	Exceeds ARAR	Probable Current Impact on Groundwater	Potential for Natural Attenuation by 2018	IRM Candidate yes/no
	Low-frequency scenario	EHQ > 1					
116-B-1 Process Effluent Trench	low	no	adequate	yes	yes	yes	yes
116-B-2 Trench	low	no	adequate	no	no	yes	no
116-B-3 Pluto Crib	low	no	adequate	no	no	yes	no
116-B-5 Crib	low	yes	adequate	no	no	yes	yes
116-C-5 Retention Basin	medium	yes	adequate	yes	yes	no	yes
116-C-1 Process Effluent Trench	medium	no	adequate	yes	yes	yes	yes
116-B-11 Retention Basin	high	yes	adequate	yes	yes	no	yes
Process Pipe (sludge)	high	yes	adequate	yes	yes	no	yes
Process Pipe (soil)	low	no	adequate	yes	yes	no	yes
116-B-13/14 Sludge Trench	medium	yes	adequate	yes	yes	no	yes
116-B-6A Crib	low	-	adequate	no	no	no	no
116-B-6B Crib	very low	no	adequate	no	no	no	no
116-B-4 French Drain	medium	-	adequate	no	no	yes	yes
116-B-9 French Drain	low	-	incomplete*	unknown*	no	unknown*	yes*
116-B-10 Dry Well	high	-	incomplete*	unknown*	no	unknown*	yes*
116-B-12 Seal Pit Crib	medium	-	adequate	no	yes	no	yes
132-B-4 and 132-B-5 (D&D Facility)	very low	yes	adequate	no	yes	no	yes
128-B-3 Dump Site	low	-	adequate	no	no	no	no
126-B-2 Clear Well	low	-	adequate	no	no	no	no
118-B-5, 118-B-7, and 118-B-10 Burial grounds							yes

Source: 100-BC-1 LFI (DOE-RL 1993b)
EHQ = Environmental Hazard Quotient calculated by the qualitative ecological risk assessment
- = Not rated by the qualitative ecological risk assessment
* = Data needed concerning nature and vertical extent of contamination, waste site remains an IRM candidate until data are available, therefore not addressed in this FFS.
ARAR = Applicable or Relevant and Appropriate Requirements, specifically the *Washington State Model Toxics Control Act* Method B concentration values for soils

Table 2-2. 100-BC-1 Site Description. (2 pages)

Site #/Name/(Alias)	Use	Physical Dimensions	Data Source
116-B-11 Retention Basin (107-B Retention Basin)	Held cooling water effluent from B Reactor for cooling/decay before release to the Columbia River; large leaks of effluent to soil.	70 x 6 m (229.6 x 19.6 ft) deep 143.3 x 70.1 x 1.5 m (469.2 x 229.6 x 4.9 ft) deep	Historical
116-C-5 Retention Basin (107-C Retention Basin)	Held cooling water effluent from B and C Reactors for cooling/decay before release to the Columbia River; large leaks of effluent to soil.	101 m (331 ft) diameter x 4.9 m (16.1 ft) deep	LFI, Historical
Pipelines	Transported reactor cooling water from reactors to retention basins, outfall structures, 116-B-1, and 116-C-1 trenches; leaked effluent to soil; contains contaminated sludge and scale.	Buried 6 m (19.6 ft) bls. ~6533 m (21,433.7 ft) total length; various diameters; various depths	Historical
116-B-1 Effluent Disposal Trench (107-B Liquid Waste Disposal Trench)	Received 60 million liters of high activity effluent produced by failed fuel elements; disposed effluent to the soil.	Unlined trench, backfilled. 61 x 9 x 5 m (200 x 29.5 x 16.4 ft) deep 114.3 x 15.2 x 4.6 m (375 x 49.9 x 15.1 ft) deep	LFI, Historical
116-C-1 Effluent Disposal Trench (107-C Liquid Waste Disposal Trench)	Received 700 million liters of high activity effluent produced by failed fuel elements; disposed effluent to the soil.	Unlined trench, backfilled. 175.3 x 38.1 x 7.6 m (575.1 x 125 x 24.9 ft) deep	Historical
116-B-13 Sludge Trench (107-B South Sludge Trench)	Received sludge from 116-B-11 retention basin; sludge disposed to soil then trench backfilled.	Unlined trench, backfilled. 15.2 x 15.2 x 3 m (49.9 x 49.9 x 9.8 ft) deep	No Analytical Data
116-B-14 Sludge Trench (107-B North Sludge Trench	Received sludge from 116-B-11 retention basin; sludge disposal to soil then trench backfilled.	Unlined trench, backfilled. 36.6 x 3 x 3 m (120.1 x 9.8 x 9.8 ft) deep	No Analytical Data
116-B-4 French Drain (105 Dummy Decontamination French Drain)	Received 300,000 liters of effluent, e.g., contaminated spend acid from dummy decontamination facility; disposed effluent to soil.	Gravel filled pipe. 1.2 m (3.9 ft) diameter x 6.1 m (20 ft) deep	Historical
116-B-12 Seal Pit Crib (117-B Crib)	Received drainage from confinement seal system in 117-B building seal pits; disposed effluent to soil.	Timber reinforced excavation, filled with gravel, soil covered. 3 x 3 x 3 m (9.8 x 9.8 x 9.8 ft) deep.	No Analytical Data
116-B-5 Crib (108-B Crib)	Received 10 million liters of low-level effluent from contaminated maintenance shop and decontamination pad in 108-B building including liquid tritium waste; disposed effluent to soil.	25.6 x 4.9 x 3.5 m (84 x 16.1 x 11.5 ft) deep	LFI, Historical
118-B-5 Burial Ground (Ball 3X)	Received highly contaminated reactor components removed from B Reactor.	Unlined L-shaped excavation. 2 m (6.5 ft) cover 22 x 22 x 8 x 14 x 14 x 8.2 x 6.1 m (72.2 x 72.2 x 26.25 x 46 x 46 x 26.9 x 20 ft) deep	Historical
118-B-7 Burial Ground (111-B Solid Waste Burial Site)	Miscellaneous solid waste, (e.g., decontamination materials and associated equipment).	Unlined excavation. 2 m (6.5 ft) cover 7.3 x 7.3 x 2.4 m (23.95 x 23.95 x 7.87 ft) deep	Historical

Table 2-2. 100-BC-1 Site Description.

Site #/Name/(Alias)	Use	Physical Dimensions	Data Source
118-B-10 Burial Ground (115-B/C Caisson Site)	Received activated reactor components; buried in unlined excavation; backfilled with soil.	Unlined excavation. 2 m (6.5 ft) cover 26.8 x 17.7 x 6.1 m (87.9 x 58 x 20 ft) deep	Historical
132-B-4 Filter Building (117-B Filter Building)	Contaminated building demolished in place; buried; covered with fill. (D&D Facility.)	Demolished reinforced concrete structure. Building: 18.0 x 11.9 x 8.2 m (59.1 x 39.05 x 26.9 ft) Tunnels: 58 m (190.3 ft) long	D&D
132-B-5 Gas Recirculation Building (115-B/C Gas Recirculation Facility)	Contaminated gas recirculation building demolished in place; buried; covered with fill. (D&D Facility.)	Demolished reinforced concrete structure. 51.2 x 25.9 x 3.4 m (167.98 x 85 x 11.15 ft)	D&D

Source: 100-BC-1 LFI (DOE-RL 1993c)
LFI = limited field investigation
D&D = decontamination and decommissioning

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Table 2-3. Potential Preliminary Remediation Goals.

Table 2-3. Potential Preliminary Remediation Goals

	HUMAN-HSRAM (a,b)		PROTECTION of GROUNDWATER (a,c)	BACKGROUND (d,e)	CRQL/CRDL (f)	ZONE SPECIFIC PRG	
	TR = 1E-06	HQ = 0.1				1 (g) 0-10 ft.	2 (h) >10 ft.
RADIONUCLIDES (pCi/g)							
Am-241	76.9	N/A	31	N/C	1	31	31
C-14	44,200	N/A	18	N/C	50	50	50
Cs-134	3,460	N/A	517	N/C	0.1	517	517
Cs-137	5.68	N/A	775	1.8	0.1	6	775
Co-60	17.5	N/A	1,292	N/C	0.05	18	1,292
Eu-152	5.96	N/A	20,667	N/C	0.1	6	20,667
Eu-154	10.6	N/A	20,667	N/C	0.1	11	20,667
Eu-155	3,080	N/A	103,000	N/C	0.1	3,080	103,000
H-3	2,900,000	N/A	517	N/C	400	517	517
K-40	12.1	N/A	145	19.7	4	19.7	145
Na-22	545	N/A	207	N/C	4 (i)	207	207
Ni-63	184,000	N/A	46,500	N/C	30	46,500	46,500
Pu-238	87.9	N/A	5	N/C	1	5	5
Pu-239/240	72.8	N/A	4	0.035	1	4	4
Ra-226	1.1	N/A	0.03	0.98	0.1	1	1
Sr-90	1,930	N/A	129	0.36	1	129	129
Tc-99	28,900	N/A	26	N/C	15	26	26
Th-228	7,260	N/A	0.1	N/C	1 (j)	1	1
Th-232	162	N/A	0.01	N/C	1	1	1
U-233/234	165	N/A	5	1.1	1	5	5
U-235	23.6	N/A	6	N/C	1	6	6
U-238 (k)	58.4	N/A	6	1.04	1	6	6
INORGANICS (mg/kg)							
Antimony	N/A	167	0.002	N/C	6	6	6
Arsenic	16.2	125	0.013	9	1	9	9
Barium	N/A	29,200	258	175	20	258	258
Cadmium	1,360	417	0.775	N/C	0.5	0.8	0.775
Chromium VI	204	2,086	0.026	28	1	28	28
Lead	N/C	N/C	8	14.9	0.3	14.9	14.9
Manganese	N/A	2,086	13	583	1.5	583	583
Mercury	N/A	125	0.31	1.3	0.02	1.3	1.3
Zinc	N/A	100,000	775	79	2	775	775
ORGANICS (mg/kg)							
Aroclor 1260 (PCB)	4.34	N/A	1.37	<0.033	0.033	1	1
Benzo(a)pyrene	5	N/A	5.68	<0.330	0.330	5	6
Chrysene	N/A	N/A	0.01	<0.330	0.330	0.330	0.330
Pentachlorophenol	300	N/A	0.27	<0.8	0.8	0.8	0.8

TR=Target Risk; HQ= Hazard Quotient; N/A=Not Applicable; N/C=Not calculated

(a) Risk-based numbers based on a 1E-06 increased cancer risk for carcinogens and radionuclides and a noncancer hazard quotient of 0.1 for noncarcinogens.

(b) Occasional Use Scenario

(c) Based on Summer's Model (EPA 1989b)

(d) Status Report, Hanford Site Background: Evaluation of Existing Soil Radionuclide Data (Letter #008106)

(e) Hanford Site Background: Part 1, Soil Background for Nonradioacitve Analytes, DOE/RL-92-24, Rev. 2.

(f) Based on 100-BC-5 OU Work Plan QAPP (DOE-RL 1992)

(g) PRGs are established to be protective of groundwater, human and ecological receptors.

(h) PRGs are established to be protective of groundwater.

(i) Based on gross beta analysis

(j) Detection limit assumed to be same as Th-232

(k) Includes total U if no other data exist

(l) Value calculated exceeds 1,000,000 ppm therefore use 100,000 ppm as default

Table 2-4. Reduced Infiltration Concentrations.

Analyte	Soil Concentration
RADIONUCLIDES	**pCi/g**
^{241}Am	5,012
^{14}C	2,924
^{134}Cs	83,539
^{137}Cs	125,309
^{60}Co	208,848
^{152}Eu	3,341,560
^{154}Eu	3,341,560
^{155}Eu	16,707,800
^{3}H	83,539
^{40}K	23,391
^{22}Na	33,416
^{63}Ni	7,518,510
^{238}Pu	835
$^{239/240}Pu$	627
^{226}Ra	4
^{90}Sr	20,885
^{99}Tc	4,177
^{228}Th	16.708
^{232}Th	2.088
$^{233/234}U$	835
^{235}U	1,002
^{238}U	1,002
INORGANICS	**mg/kg**
Antimony	0.251
Arsenic	2.088
Barium	41,770
Cadmium	125.309
Chromium (VI)	4.177
Lead	1,253
Manganese	2,088
Mercury	50.123
Zinc	125,309
ORGANICS	**mg/kg**
Aroclor 1260	221
Benzo(a)pyrene	919
Chrysene	2
Pentachlorophenol	44

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Table 2-5. 116-B-11 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-5. 116-B-11 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-B-11	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO		NO		NO		NO		NO		NO		NO	
C-14	4.69E+00	NO	2.59E+02	YES		NO		NO		NO		NO		NO		NO		NO	YES
Cs-134	5.10E-01	NO	4.60E-01	NO	7.36E-03	NO	1.10E-01	NO	5.06E-02	NO	2.94E-03	NO	1.43E-03	NO		NO		NO	
Cs-137	**3.74E+02**	YES	**8.30E+02**	YES	**2.91E+02**	YES	2.70E+02	NO	1.45E+02	NO	4.98E+01	NO	3.04E+01	NO		NO	7.61E+00	NO	YES
Co-60	**3.17E+03**	YES	**4.39E+03**	YES	**2.07E+02**	YES	2.07E+02	NO	9.27E+01	NO	2.56E-01	NO	4.27E-01	NO		NO		NO	YES
Eu-152	**1.02E+04**	YES	**2.83E+04**	YES	**1.02E+03**	YES	9.72E+02	NO	2.87E+02	NO	1.90E+00	NO	4.86E+00	NO		NO		NO	YES
Eu-154	**3.12E+03**	YES	**8.24E+03**	YES	**2.22E+02**	YES	2.84E+02	NO	9.09E+01	NO	1.65E+00	NO	9.94E-01	NO		NO		NO	YES
Eu-155	9.42E+01	NO	5.03E+02	NO	5.89E+00	NO	5.14E+00	NO	7.70E+00	NO	1.71E+00	NO	1.39E-01	NO		NO	2.35E-02	NO	
H-3	3.69E+01	NO	1.01E+02	NO	1.70E+01	NO	6.89E-01	NO	7.70E+00	NO	1.54E+00	NO	2.27E+00	NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63	**5.10E+04**	YES	3.76E+04	NO		NO		NO		NO		NO		NO		NO		NO	YES
Pu-238	4.14E+00	NO	**7.66E+00**	YES	5.11E-01	NO	2.82E-01	NO		NO		NO		NO		NO		NO	YES
Pu-239/240	**1.70E+02**	YES	**3.40E+02**	YES	**1.80E+01**	YES	**1.10E+01**	YES	**7.60E+00**	YES	6.75E-01	NO	1.40E-01	NO		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90	**2.10E+02**	YES	5.43E+01	NO	5.43E+00	NO	3.33E+00	NO	4.82E+00	NO	1.97E+00	NO	6.65E-01	NO		NO	1.15E+00	NO	YES
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)	9.90E-01	NO	**9.00E+00**	YES	2.70E-01	NO	3.90E-01	NO	4.20E-01	NO	2.20E-01	NO		NO		NO		NO	YES
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-1, 2, 7, 9

Table 2-6. 116-C-5 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection Groundwater.

Table 2-6. 116-C-5 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-C-5	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241	3.40E+01	YES	1.30E-01	NO		NO		NO	4.00E-03	NO		NO		NO		NO		NO	YES
C-14	2.59E+02	YES		NO		NO		NO	4.10E-01	NO		NO		NO		NO		NO	YES
Cs-134	7.82E+00	NO	5.52E-01	NO	1.15E-03	NO	7.82E-04	NO	6.90E-04	NO	3.91E-03	NO		NO		NO		NO	
Cs-137	1.73E+03	YES	2.15E+03	YES	2.77E+01	YES	1.04E+02	NO	8.30E+01	NO	2.21E+01	NO		NO		NO		NO	YES
Co-60	1.95E+03	YES	3.05E+02	YES	6.22E+00	NO	3.17E+01	NO	5.00E+01	NO	5.86E+00	NO		NO		NO		NO	YES
Eu-152	5.75E+03	YES	1.37E+03	YES	5.75E+00	NO	1.64E+02	NO	1.72E+02	NO	2.61E+01	NO		NO		NO		NO	YES
Eu-154	6.53E+03	YES	7.10E+02	YES	1.16E+00	NO	4.54E+01	NO	4.83E+01	NO	8.24E+00	NO		NO		NO		NO	YES
Eu-155	5.35E+02	NO	7.38E+01	NO	1.07E-01	NO	1.71E+00	NO	3.32E+00	NO	9.20E-01	NO		NO		NO		NO	
H-3	2.47E+01	NO	1.78E+03	YES		NO	2.07E-01	NO		NO		NO		NO		NO		NO	YES
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63	4.56E+03	NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238	9.40E+00	YES		NO		NO		NO		NO		NO		NO		NO		NO	YES
Pu-239/240	2.30E+02	YES	7.90E+00	YES	2.40E-01	NO	1.80E+00	NO	1.90E+00	NO	2.90E-01	NO		NO		NO		NO	YES
Ra-226	8.40E-01	NO	6.80E-01	NO		NO		NO	1.02E+00	YES		NO		NO		NO		NO	YES
Sr-90	7.70E+02	YES	2.99E+02	YES	3.12E+00	NO	6.79E+00	NO	5.43E+00	NO	4.21E+00	NO		NO		NO		NO	YES
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO	4.40E+00	YES		NO		NO		NO		NO	YES
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234	1.40E+00	NO		NO		NO	7.80E-01	NO	8.40E-01	NO		NO		NO		NO		NO	
U-235	8.00E-02	NO		NO		NO		NO	9.00E-03	NO		NO		NO		NO		NO	
U-238 (k)	3.00E+00	NO	9.90E-01	NO		NO		NO		NO		NO		NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO	2.60E+02	NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO	8.40E-01	YES		NO		NO		NO		NO	YES
Chromium VI	6.09E+02	YES		NO		NO		NO		NO		NO		NO		NO		NO	YES
Lead	5.64E+02	YES		NO		NO		NO		NO		NO		NO		NO		NO	YES
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury	4.30E+00	YES		NO		NO		NO		NO		NO		NO		NO		NO	YES
Zinc	3.09E+02	NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene	1.00E-01	NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol	9.20E-01	NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-4, 5, 8, 13
DOE-RL, 1993b, Tables 3-31, 32, 33, 36

Table 2-7. 116-B-1 Process Effluent Trench Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-7. 116-B-1 Process Effluent Trench Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)										Refined
116-B-1	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																	
Am-241		NO		NO		NO		NO	4.82E-01	NO	5.00E-02	NO	2.00E-03	NO		NO	
C-14		NO		NO		NO		NO	6.18E+00	NO	3.76E+00	NO	1.89E+00	NO		NO	
Cs-134		NO	3.13E-04	NO		NO		NO	4.53E-01	NO		NO		NO		NO	
Cs-137		NO	8.30E-02	NO		NO	1.80E-01	NO	4.39E+01	NO	1.04E+01	NO	1.39E+00	NO		NO	
Co-60		NO	2.68E-02	NO	1.34E-02	NO	3.42E-02	NO	4.76E+00	NO	3.89E-01	NO		NO		NO	
Eu-152		NO	4.42E-01	NO	3.45E-01	NO	7.07E-01	NO	1.22E+02	NO	1.76E+01	NO	4.11E+00	NO		NO	
Eu-154		NO		NO		NO	1.68E-01	NO	1.36E+01	NO	1.20E+00	NO		NO		NO	
Eu-155		NO	1.82E-02	NO	1.28E-02	NO	6.42E-03	NO	1.28E+00	NO		NO		NO		NO	
H-3		NO		NO		NO		NO	1.09E+00	NO		NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO	1.08E-01	NO		NO		NO		NO	
Pu-239/240		NO		NO		NO		NO	3.60E+00	NO	2.69E-01	NO		NO		NO	
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90		NO	8.83E-03	NO	4.75E-02	NO	2.58E-02	NO	1.32E+01	NO	5.08E+00	NO	1.54E+00	NO		NO	
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO		NO	2.80E-01	NO		NO		NO		NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO	**3.30E+01**	**YES**		NO		NO		NO	YES
Lead		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO	**8.39E+02**	**YES**		NO		NO		NO	YES
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO	1.28E+02	NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-3
DOE-RL, 1993b, Tables 3-2,3

Table 2-8. 116-C-1 Process Effluent Trench Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-8. 116-C-1 Process Effluent Trench Refined Contaminants of Potential Concern Based on Occasional Land Used Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-C-1	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO		NO		NO		NO		NO		NO		NO	
C-14		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134		NO	2.67E-04	NO	8.28E-04	NO	9.66E-03	NO	3.13E-02	NO	1.10E-02	NO		NO		NO	2.07E-01	NO	
Cs-137		NO	2.42E-01	NO	**1.18E+01**	**YES**	3.60E+01	NO	5.54E+01	NO	3.32E+02	NO	1.45E+02	NO		NO	1.38E+01	NO	YES
Co-60		NO	3.66E-02	NO	2.68E+00	NO	6.34E+01	NO	2.20E+02	NO	5.73E+01	NO	4.76E+01	NO		NO	1.17E+00	NO	
Eu-152		NO	4.86E-01	NO	**6.63E+00**	**YES**	2.12E+02	NO	4.02E+02	NO	9.72E+01	NO	2.83E+02	NO	7.96E-02	NO	1.02E+01	NO	YES
Eu-154		NO	1.56E-01	NO	3.69E+00	NO	1.70E+02	NO	1.05E+02	NO	2.19E+01	NO	5.96E+01	NO		NO	3.41E+00	NO	
Eu-155		NO	3.00E-02	NO	1.82E-01	NO	2.25E+00	NO	6.53E+00	NO	1.03E+00	NO	3.00E+00	NO		NO	5.56E-01	NO	
H-3		NO	3.32E-01	NO	1.70E+00	NO	4.46E-01	NO	9.72E-01	NO	3.40E+00	NO	1.62E+01	NO		NO	8.51E+00	NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO	7.50E-01	NO	2.10E+00	NO	1.80E+00	NO	**5.30E+00**	**YES**		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90		NO	2.65E-01	NO	2.78E-01	NO	5.36E-01	NO	5.23E-01	NO	6.65E-01	NO	5.70E+00	NO	2.51E-01	NO	3.40E-01	NO	
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO	7.50E-02	NO	3.10E-01	NO	2.20E-01	NO	3.20E-01	NO	2.50E-02	NO	1.60E-01	NO		NO	2.10E-01	NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-6

Table 2-9. 116-B-5 Crib Refined Contaminants of Potential Concern Based on Occasional land Use Scenario and Protection of Groundwater.

Table 2-9. 116-B-5 Crib Refined Contaminants of Potential Cconcern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-B-5	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO	6.00E-03	NO	2.00E-03	NO	2.00E-03	NO		NO		NO		NO		NO	
C-14		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134		NO		NO	1.33E-04	NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO	3.11E-01	NO		NO		NO		NO		NO		NO	7.61E+00	NO	
Co-60		NO		NO	2.56E+00	NO	2.60E-01	NO	1.84E-01	NO		NO		NO		NO		NO	
Eu-152		NO		NO	**1.15E+01**	**YES**	1.53E+00	NO		NO		NO		NO		NO		NO	YES
Eu-154		NO		NO	2.53E+00	NO		NO		NO		NO		NO		NO.		NO	
Eu-155		NO		NO	1.50E-02	NO		NO		NO		NO		NO		NO	2.35E-02	NO	
H-3		NO		NO	**2.96E+04**	**YES**		NO		NO	1.82E+02	NO		NO		NO		NO	YES
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90		NO		NO	1.09E-01	NO		NO	1.50E-01	NO		NO		NO		NO	1.15E+00	NO	
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO	9.02E+01	NO	**4.84E+02**	**YES**	7.86E+01	NO		NO		NO		NO		NO	YES
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO	**1.40E+00**	**YES**	1.10E+00	NO	**2.90E+00**	**YES**		NO		NO		NO		NO	YES
Zinc		NO		NO	6.84E+01	NO	6.94E+01	NO	1.25E+02	NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 3.4-1
DOE-RL, 1993b, Tables 3-24, 25

Table 2-10. 116-B-4 French Drain Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-10. 116-B-4 French Drain Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

116-B-4	Zone 1 (a)						Zone 2 (b)												Refined COPC Summary
	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO		NO		NO		NO		NO		NO		NO	
C-14		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134		NO		NO	1.84E-04	NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO	**2.08E+02**	**YES**	6.71E+01	NO		NO		NO		NO		NO	7.61E+00	NO	YES
Co-60		NO		NO	**2.68E+02**	**YES**	6.34E+00	NO		NO		NO		NO		NO		NO	YES
Eu-152		NO		NO	**4.20E+02**	**YES**	3.05E+01	NO		NO		NO		NO		NO		NO	YES
Eu-154		NO		NO	**4.54E+01**	**YES**	4.83E+00	NO		NO		NO		NO		NO		NO	YES
Eu-155		NO		NO	6.53E+00	NO	2.14E-01	NO		NO		NO		NO		NO	2.35E-02	NO	
H-3		NO		NO	1.22E+02	NO		NO		NO		NO		NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO	2.91E-01	NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO	**8.60E+00**	**YES**	7.70E+00	YES		NO		NO		NO		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90		NO		NO	3.73E+01	NO	2.24E+00	NO		NO		NO		NO		NO	1.15E+00	NO	
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO	2.80E-01	NO		NO		NO		NO		NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Table 3.4-1
as 116-B-3, 105-B Pluto Crib

Table 2-11. 100 B/C Pipeline Sludge Refined Contaminants of Potential Concern Based on Occasional Use Scenario.

Table 2-11. 100B/C Pipeline Sludge Refined Contaminants of Potential Concern Based on Occasional Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
100 B/C PIPELINE SLUDGE	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO		NO		NO		NO		NO		NO		NO	
C-14	1.20E+01	NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134	1.66E+01	NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-137	**1.11E+05**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Co-60	**2.81E+03**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Eu-152	**1.68E+04**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Eu-154	**3.41E+03**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Eu-155	**9.42E+03**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
H-3	2.47E+00	NO		NO		NO		NO		NO		NO		NO		NO		NO	
K-40		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63	**6.18E+04**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Pu-238	**1.41E+02**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Pu-239/240	**2.80E+03**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Sr-90	**2.04E+03**	**YES**		NO		NO		NO		NO		NO		NO		NO		NO	YES
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)	2.30E-01	NO		NO		NO		NO		NO		NO		NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-24

Table 2-12. 100 B/C Pipeline Soil Refined Contaminants of Potential Concern Based on Occasional Use Scenario.

Table 2-12. 100 B/C Pipeline Soil Refined Contaminants of Potential Concern based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
100 B/C PIPELINE SOIL	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
C-14		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-134		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO	3.96E-04	NO	4.32E-04	NO	6.44E-01	NO	9.20E-04	NO	2.44E-01	NO	6.44E-04	NO		NO	
Co-60		NO		NO	4.36E+00	NO	3.67E+00	NO	**4.64E+03**	**YES**	1.45E+02	NO	**2.56E+03**	**YES**	4.01E+01	NO		NO	YES
Eu-152		NO		NO	2.32E-01	NO	2.20E+00	NO	1.02E+02	NO	1.59E+01	NO	8.17E+01	NO	3.78E-01	NO		NO	
Eu-154		NO		NO	7.96E-01	NO	5.75E+00	NO		NO	3.36E+01	NO	1.11E+02	NO	1.99E+00	NO		NO	
Eu-155		NO		NO	1.85E-01	NO	8.80E-01	NO	1.02E+02	NO	5.68E+00	NO	2.75E+01	NO	4.54E-01	NO		NO	
H-3		NO		NO	8.88E-03	NO	2.57E-02	NO	3.21E+03	NO	2.89E-01	NO	1.61E+03	NO	8.67E-02	NO		NO	
K-40		NO		NO		NO		NO	4.86E+01	NO		NO	3.81E+01	NO		NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO		NO		NO		NO	3.61E-01	NO		NO		NO	
Ra-226		NO		NO	2.90E-01	NO	2.20E-01	NO	**6.40E+00**	**YES**	2.20E+00	NO	**1.00E+01**	YES	1.40E-01	NO		NO	YES
Sr-90		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Tc-99		NO		NO	3.87E-01	NO	1.56E+00	NO	8.15E+00	NO	**1.36E+02**	**YES**	6.79E+01	NO	8.83E+00	NO		NO	YES
Th-228		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
INORGANICS (mg/kg)		NO		NO		NO		NO	4.20E-01	NO	5.20E-01	NO		NO		NO		NO	
Antimony																			
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Aroclor 1260 (PCB)																			
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	
#VALUE!		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-19, 20

Table 2-13. 100-BC-1 Waste Site Profile.
(Page 1 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-B-11 (Retention Basin)	118835.0	210.3	111.3	23406.0	6.1	Soil Concrete	Radionuclides	pCi/g	
							^{14}C	2.59(10^2)	NO
							^{60}Co	4.39(10^3)	NO
							^{137}Cs	8.30(10^2)	NO
							^{152}Eu	2.83(10^4)	NO
							^{154}Eu	8.24(10^4)	NO
							^{63}Ni	5.10(10^4)	NO
							^{238}Pu	7.66	NO
							$^{239/240}Pu$	3.40(10^2)	NO
							^{90}Sr	2.10(10^2)	NO
							^{238}U	9.00	NO
							Inorganics	mg/kg	
							Arsenic	assumed from group data	YES(b)
							Cadmium		
							Chromium VI		
							Lead		

Table 2-13. 100-BC-1 Waste Site Profile
(Page 2 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-C-5 (Retention Basin)	145210.0	(c)	(c)	23805.0	6.1	Soil Concrete	<u>Radionuclides</u>	<u>pCi/g</u>	
							^{241}Am	$3.40(10^{1})$	NO
							^{14}C	$2.59(10^{2})$	NO
							^{60}Co	$1.95(10^{3})$	NO
							^{137}Cs	$2.15(10^{3})$	NO
							^{152}Eu	$5.75(10^{3})$	NO
							^{154}Eu	$6.53(10^{3})$	NO
							^{3}H	$1.78(10^{3})$	NO
							^{238}Pu	9.40	NO
							$^{239/240}$Pu	$2.30(10^{2})$	NO
							^{90}Sr	$7.70(10^{2})$	NO
							^{228}Th	4.40	NO
							<u>Inorganics</u>	<u>mg/kg</u>	
							Cadmium	$8.40(10^{-1})$	NO
							Chromium VI	$6.09(10^{2})$	YES
							Lead	$5.64(10^{2})$	NO
							Mercury	4.30	NO
100 B/C Pipelines	302973.0	6533.0	varies	varies	varies	Soil Steel Concrete Sludge	<u>Radionuclides</u>	<u>pCi/g</u>	
							^{60}Co	$2.81(10^{3})$	NO
							^{137}Cs	$1.18(10^{5})$	NO
							^{152}Eu	$1.68(10^{4})$	NO
							^{154}Eu	$3.44(10^{3})$	NO
							^{155}Eu	$9.42(10^{3})$	NO
							^{63}Ni	$6.18(10^{4})$	NO
							^{238}Pu	$1.41(10^{2})$	NO
							$^{239/240}$Pu	$2.80(10^{3})$	YES(d)
							^{90}Sr	$2.04(10^{3})$	NO
100 B/C Pipeline Leak at Junction Box	1325.0	76.2	5.8	441.0	3.0	Soil Concrete	<u>Radionuclides</u>	<u>pCi/g</u>	
							^{137}Cs	$4.64(10^{3})$	NO
							$^{239/240}$Pu	$1.00(10^{1})$	NO
							^{90}Sr	$1.36(10^{2})$	NO

Table 2-13. 100-BC-1 Waste Site Profile
(Page 3 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-B-1 (Effluent Disposal Trench)	3001.0	112.2	13.1	1470.0	4.6	Soil	Inorganics Chromium VI Manganese	mg/kg 3.30(10^1) 8.39(10^2)	 YES NO
116-C-1 (Effluent Disposal Trench)	31441.0	169.8	32.6	5535.0	5.8	Soil Concrete	Radionuclides ^{137}Cs ^{152}Eu $^{239/240}$Pu Inorganics Chromium VI	pCi/g 1.18(10^1) 6.63 5.30 mg/kg assumed from process effluent trench group data	 NO NO NO YES(e)
116-B-13 (Sludge Trench)	924.0	15.2	15.2	228	4.0	Sludge	Radionuclides ^{241}Am ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{63}Ni ^{238}Pu $^{239/240}$Pu ^{90}Sr ^{228}Th Tritium ^{238}U Inorganics Arsenic Barium Cadmium Chromium VI Mercury Lead	assumed from area retention basins	YES(b)

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Table 2-13. 100-BC-1 Waste Site Profile
(Page 4 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-B-14 (Sludge Trench)	439.0	36.6	3.0	110.0	4.0	Sludge	<u>Radionuclides</u> ^{241}Am ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{63}Ni ^{238}Pu $^{239/240}$Pu ^{90}Sr ^{228}Th Tritium ^{238}U <u>Inorganics</u> Arsenic Barium Cadmium Chromium VI Mercury Lead	assumed from area retention basins	YES(b)
116-B-4 (French Drain)	3.2	1.2 (f)	1.2 (f)	1.1	2.7	Soil Steel	<u>Radionuclides</u> ^{60}Co ^{137}Cs ^{152}Eu ^{154}Eu $^{239/240}$Pu	<u>pCi/g</u> 2.68(10^2) 2.08(10^2) 4.20(10^2) 4.54(10^1) 8.60	 NO NO NO NO NO
116-B-12 (Seal Pit Crib)	0.0	0.0	0.0	0.0	0.0	NA	None	Assume data from seal pit cribs	NO(e)
116-B-5 Crib	1022.0	29.0	8.2	232.0	4.3	Soil Concrete	<u>Radionuclides</u> ^{152}Eu Tritium <u>Inorganics</u> Barium Mercury	<u>pCi/g</u> 1.15(10^1) 2.96(10^4) <u>mg/kg</u> 4.84(10^2) 2.90	 NO NO NO NO

Table 2-13. 100-BC-1 Waste Site Profile
(Page 5 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-B-5 Ball 3X Burial Ground	3297.0	varies	varies	907.0	6.1	Misc. Solid Waste	Radionuclides ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{63}Ni ^{90}Sr Tritium Inorganics Cadmium Lead Mercury Organics -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(h)	NO(g)

Table 2-13. 100-BC-1 Waste Site Profile
(Page 6 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-B-7 Burial Ground	61.0	7.3	7.3	46	2.4	Misc. Solid Waste	<u>Radionuclides</u> ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{63}Ni ^{90}Sr Tritium <u>Inorganics</u> Cadmium Lead Mercury <u>Organics</u> -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(h)	NO(g)

Table 2-13. 100-BC-1 Waste Site Profile
(Page 7 of 8)

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-B-10 Burial Ground	1346.0	26.8	17.7	402	6.1	Misc. Solid Waste	Radionuclides ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{63}Ni ^{90}Sr Tritium Inorganics Cadmium Lead Mercury Organics -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(h)	NO(g)
132-B-4 Filter Building (D&D Facility)	0	0	0	0	0	NA	None	NA	NA

Table 2-13. 100-BC-1 Waste Site Profile

Waste Site/Group	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
132-B-5 Gas Recirculation Building (D&D Facility)	0	0	0	0	0	NA	None	NA	NA

a Where concentration exceeds PRG.
b Based on retention basin group data.
c Contamination is defined by an additional 12.2 m (40 ft) radius beyond the retention basin walls
d Data is from pipeline sludge. Although the in situ PRG are exceeded, impact to groundwater is expected to be negligible due to containment of the material by the pipe.
e Based on group data.
f 1.2 m (4 ft) is the diameter of the french drain
g Assumed to meet in situ PRG.
h No quantitative data is available. Constituents are assumed from Miller and Wahlen 1987.

PRG = preliminary remediation goals
COPC = contaminants of potential concern
NA = not applicable
Dimensions = Contaminated volume dimensions from Appendix A.
D&D = decontamination and decommissioning

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3.0 RESULTS OF THE PLUG-IN APPROACH

This section provides the "plug-in" (Section 1.4 of the Process Document) approach as applied to the interim remedial measure candidate sites in the 100-BC-1 Operable Unit. The plug-in approach requires identification of the waste site group to which a waste site belongs and an evaluation of the alternate applicable criteria.

Waste site identification is accomplished by using the site descriptions defined in Section 2.0 and by placing the site into the appropriate group in Figure 1.4 of the Process Document. It may also be necessary to refer to the group descriptions defined in Section 3.0 of the Process Document. The appropriate group for each site is identified in Table 3-1.

Table 3-1 presents the evaluation of the alternative applicability criteria for each IRM waste site. The evaluation represents Step 6 of the plug-in approach and identifies which alternatives and enhancements apply to each waste site. Any deviation from alternatives developed for the appropriate group in the Process Document (Section 5.0) are identified by a (d). As stated in Step 6, deviations require additional consideration in subsequent chapters; however, sites with no deviation plug-in to the analysis performed for the respective group.

Based on the information presented in Section 2.0, waste sites 132-B-4 and 132-B-5 belong to the decontamination and decommissioning (D&D) group. As discussed in Section 5.0 of the Process Document, the D&D group falls under a no action alternative based on the current site conditions. The D&D facilities were remediated to meet allowable residual contamination levels established by the U.S. Department of Energy. Therefore, the no action alternative applies to waste sites 132-B-4 and 132-B-5.

The deviation in Table 3-1 indicates waste site 116-C-5 retention basin has organic contamination; therefore, thermal desorption will be added as an enhancement to the treatment alternative.

3.1 EXAMPLE APPLICATION OF THE PLUG-IN APPROACH (116-B-1)

To achieve further understanding of the plug-in approach (Section 1.4 of the Process Document), an example of its application has been developed. The example site, 116-B-1, will be evaluated as dictated by the plug-in approach. The waste site profile has been defined in Section 2.0 therefore completing Step 4 of the approach. Steps 5 and 6 of the approach are completed below.

3.1.1 Identification of Appropriate Group

Waste site 116-B-1 process effluent trench is assessed against the elements of Figure 1-4 of the Process Document to ensure that the appropriate group is identified.

Table 2-2 does not indicate that the site 116-B-1 received solid waste, and states that effluent was disposed to the soil. This indicates that site 116-B-1 is a contaminated soil site used for liquid disposal. Table 2-2 indicates that the site 116-B-1 is an unlined trench and that the site received effluent from the reactor. It can be concluded that the appropriate waste site group for 116-B-1 is the process effluent trenches. The profile for the group and the associated detailed and comparative analyses are documented in the Process Document.

3.1.2 Evaluation of the Alternative Criteria

Based on the description and profile developed for waste site 116-B-1 in Section 2.0, an evaluation of the alternative criteria can be accomplished. The evaluation of each alternative is presented below.

No Action - There is data indicating that there is contamination present at the site which warrants an interim action, therefore, no action is not an acceptable alternative.

Institutional Controls - Refined COPC are identified for waste site 116-B-1 in Table 2-13, indicating that there are contaminants present that exceed PRG. Therefore, institutional controls will not effectively address contaminants at the site.

Containment - Because there are contaminants that exceed reduced infiltration concentrations, containment at waste site 116-B-1 may not be applicable.

Removal/Disposal - Because contaminants exceed PRG, this alternative may be applicable.

In Situ Treatment - Because contaminants exceed PRG, and the contaminated lens is <5.8 m, the in situ treatment option may be applicable.

Removal/Treatment/Disposal - Because contaminants exceed PRG, this alternative may be applicable. The thermal desorption enhancement is not necessary since organic contaminants are not present at the site.

This evaluation resulted in identifying applicable alternatives. These results are compared to the results of the group analysis presented in Table 5-1 of the Process Document to identify deviations.

	116-B-1 Alternatives	Group Alternatives
Applicable	Removal/Disposal In Situ Treatment Removal/Treatment/Disposal - no enhancements	Removal/Disposal In Situ Treatment Removal/Treatment/Disposal - no enhancements
Not applicable	No Action Institutional Controls Containment	No Action Institutional Controls Containment

The alternatives for waste site 116-B-1 are the same as those for the process effluent group; therefore, no deviations are identified and the site effectively plugs into the analyses for the group.

Table 3-1. Comparison of Waste Sites and Alternatives. (page 1 of 2)

Alternative	Waste Site Group / Applicability Criteria and Enhancements	132-B-4 132-B-5 D&D Facility	116-B-11 Retention Basin	116-C-5 Retention Basin	PIPE-LINES Pipeline	116-B-1 Process Effluent Trench
		Are Applicability Criteria and Enhancements Met?				
No Action						
SS-1 SW-2	Criterion: • Has site been effectively addressed in the past?	Yes	No	No	No	No
Institutional Controls						
SS-2 SW-2	Criterion: • Contaminants < PRG	Yes	No	No	No	No
Containment						
SS-3 SW-3	Criteria: • Contaminants > PRG	No	Yes	Yes	Yes	Yes
	• Contaminants < reduced infiltration concentrations	No	No	No	Yes	No
Removal/Disposal						
SS-4 SW-4	Criterion: • Contaminants > PRG	No	Yes	Yes	Yes	Yes
In Situ Treatment						
SS-8A	Criteria: • Contaminants > PRG	No	Yes	Yes	NA	Yes
	• Contamination < 5.8 m in depth	NA	No	No	NA	Yes
SS-8B	Criteria: • Contaminants > PRG	NA	NA	NA	Yes	NA
	• Contaminants < reduced infiltration concentrations	NA	NA	NA	Yes	NA
SW-7	Criteria: • Contaminants > PRG	NA	NA	NA	NA	NA
	• Contaminants < reduced infiltration concentrations	NA	NA	NA	NA	NA
Removal/Treatment/Disposal						
SS-10	Criterion: • Contaminants > PRG	No	Yes	Yes	Yes	Yes
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system)	NA	No	Yes(d)	No	No
	• Percentage of contaminated volume less than twice the PRG for cesium-137.		33%	33%	100%	100%
SW-9	Criterion: • Contaminants > PRG	NA	NA	NA	NA	NA
	Enhancement: • Organic contaminants	NA	NA	NA	NA	NA

Table 3-1. Comparison of Waste Sites and Alternatives. (page 2 of 2)

Waste Site Group		116-C-1 Process Effluent Trench	116-B-13 116-B-14 Sludge Trench	116-B-4 Dummy Decon/ French Drain	116-B-12 Seal Pit Crib	116-B-5 Special Crib	118-B-5 118-B-7 118-B-10 Burial Ground
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**					
No Action							
SS-1 SW-2	Criterion: • Has site been effectively addressed in the past?	No	No	No	Yes	No	No
Institutional Controls							
SS-2 SW-2	Criterion: • Contaminants < PRG	No	No	No	No	No	No
Containment							
SS-3 SW-3	Criteria: • Contaminants > PRG • Contaminants < reduced infiltration concentrations	Yes No	Yes No	Yes Yes	NA NA	Yes Yes	Yes Yes
Removal/Disposal							
SS-4 SW-4	Criterion: • Contaminants > PRG	Yes	Yes	Yes	NA	Yes	Yes
In Situ Treatment							
SS-8A	Criteria: • Contaminants > PRG • Contamination < 5.8 m in depth	Yes Yes	Yes Yes	Yes Yes	NA NA	Yes Yes	NA NA
SS-8B	Criteria: • Contaminants > PRG • Contaminants < reduced infiltration concentrations	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
SW-7	Criteria: • Contaminants > PRG • Contaminants < reduced infiltration concentrations	NA NA	NA NA	NA NA	NA NA	NA NA	Yes Yes
Removal/Treatment/Disposal							
SS-10	Criterion: • Contaminants > PRG	Yes	Yes	Yes	NA	Yes	NA
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system) • Percentage of contaminated volume < twice the PRG for ^{137}Cs	No 0%	No 67%	No 67%	NA NA	No 100%	NA NA
SW-9	Criterion: • Contaminants > PRG	NA	NA	NA	NA	NA	Yes
	Enhancement: • Organic contaminants	NA	NA	NA	NA	NA	Yes

NA - Not Applicable d - deviation from waste group PRG - Preliminary Remediation Goals Decon - decontamination

4.0 ALTERNATIVE DEVELOPMENT

This section describes the alternative enhancement and site-specific alternative development for waste sites that do not align with the Process Document group profiles.

Alternatives do not require further development if the site plugs directly into the group's profile (Process Document, Section 1.4, Step 6a). Sites that meet this requirement include 116-B-11, pipelines, 116-B-1, 116-C-1, 116-B-13, 116-B-14, 116-B-4, 116-B-12, 118-B-5, 118-B-7, 118-B-10, 132-B-4 and 132-B-5. The 116-B-5 waste site is considered a special crib due to its unique waste stream. Because the special crib category contains sites associated with unique project or facilities, they must be addressed individually, and no group profile is developed. However, in the case of waste site 116-B-5, based on the evaluation in Table 3-1, it is apparent that the alternatives are consistent with the dummy decontamination crib/french drain group.

Sites that do not plug in directly (Process Document, Section 1.4, Step 6b) can be divided into two groups. The first group includes sites that require enhancements to an alternative or an inclusion, or dismissal of an alternative as originally proposed. The site that meets this requirement and applicable deviation is the waste site 116-C-5 retention basin. The waste site 116-C-5 requires thermal desorption as an enhancement option to the removal/treatment/disposal alternative, therefore, additional development of the technology and alternative are not required because the Process Document incorporates the appropriate enhancements in Section 1.4.

The second group of sites that do not plug in are those sites that require a significant modification to an alternative such as changes in the excavation process or disposal options. Alternatives for sites included in this second set will require additional development. None of the sites within the 100-BC-1 Operable Unit fit into this second set; therefore, additional alternative development is not required.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analysis of the alternatives applicable to the individual waste sites within the 100-BC-1 Operable Unit. In the detailed analysis, each alternative is assessed against the evaluation criteria described in Section 5.1 of the Process Document. The purpose of the detailed analysis is to provide a basis for the comparison of the alternatives and to support a subsequent evaluation of the alternatives made by the decision makers in the remedy selection process.

The detailed analysis for the sites within 100-BC-1 Operable Unit is presented in the following manner:

- The detailed analyses for waste sites that do not deviate from the waste site groups are referenced to the group discussion presented in the Process Document (see Table 5-1).
- The detailed analyses for waste sites that deviate from the waste site groups are discussed in Section 5.2.

The 100-BC-1 individual waste sites are discussed in Section 5.2.

5.1 SITE-SPECIFIC COMMON EVALUATION CONSIDERATIONS

Based on the comparison presented in Table 3-1, several of the individual waste sites within 100-BC-1 Operable Unit plug into the waste site group alternatives; therefore, the detailed analysis for these individual waste sites can be referenced to the Process Document. These individual waste sites include 116-B-11, pipelines, 116-B-1, 116-C-1, 116-B-13, 116-B-14, 116-B-4, 116-B-12, 118-B-5, 118-B-7, 118-B-10, 132-B-4, and 132-B-5. The 116-B-5 waste site is considered a special crib due to its unique waste stream. Because the special crib category contains sites associated with unique projects or facilities, they must be addressed individually, and no group profile is developed. However, in the case of waste site 116-B-5, based on the evaluation in Table 3-1, it is apparent that the detailed analysis for the dummy decontamination crib/french drain group can be assumed for this site.

The detailed analysis for the remaining waste site (116-C-5) is discussed below in Section 5.1.1. Tables 5-2 and 5-3 present remediation costs and durations associated with all waste sites.

5.1.1 116-C-5 Retention Basin

This section evaluates the alternatives that deviate from the Process Document for the 116-C-5 retention basin site against the CERCLA evaluation criteria. Alternatives SS-4 and SS-10 are applicable to this site. Alternative SS-10 deviates from the waste site group analysis in that thermal desorption is included as an enhancement to the treatment process.

Alternative SS-10, which includes thermal desorption, would impact transportation. This alternative would require the transport of equipment, contaminated and solid waste, and clean fill by truck onsite. The commuter traffic flow for this alternative would be considered an impact in the 100 Area.

The thermal desorption included in this alternative may impact air quality. Organics present at waste site 116-C-5 may be emitted during the thermal desorption process. However, mitigative measures would be employed as needed to ensure that these potential short-term impacts on air quality are minor and acceptable.

Excavation, thermal desorption, and disposal of the contaminated soil from the 116-C-5 retention basin would not impact ecological resources. In fact, revegetation and restoration efforts would, in the long-term, benefit natural resources.

The potential of this alternative for disturbing cultural resources is considered high. Actions to mitigate adverse impacts on significant cultural resources would have to be taken before implementing this alternative.

The socioeconomic impact of this alternative would be insignificant. The number of employees involved and the income gained would be insignificant when compared with the total Tri-Cities area employment. Workers would likely come from the regional labor force. so, consistent with overall employment, income, and population impact effects on housing would be insignificant.

This alternative would create minor short-term impacts to noise and visual resources during the treatment process. Noise mitigation would be provided should noise levels become a problem. In an effort to mitigate potential impacts to visual resources, dust controls and backfilling with clean soil then contouring and revegetating would be implemented when needed.

Resources, such as federal funds, imported soil and rock for soil cover, and consumables such as fuel, electricity, chemicals, and personal protective equipment would be irreversibly committed.

The indirect impact of this alternative would be an enhancement of the natural resources through revegetation. This alternative could add to the cumulative impact on transportation and cultural, noise and visual resources from Hanford Site remediation.

As stated in the Process Document, this alternative may comply with Executive Order 12898, Environmental Justice. Excavation always poses the risk of unearthing Native American burials. This risk of an adverse impact on Native American cultural resources may be disproportionately large compared to other segments of the population. This alternative would protect groups of the population with higher fish consumption patterns than the general population from contamination at the 116-C-5 retention basins.

5.2 SITE-SPECIFIC DETAILED ANALYSIS

This detailed analysis for the 116-C-5 waste site is discussed in the following sections.

5.2.1 116-C-5 Retention Basin

This section evaluates the alternatives that deviate from the Process Document for the 116-C-5 retention basin site against the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) evaluation criteria. Alternatives SS-4 and SS-10 are applicable to this site. However, only Alternative SS-10 deviates from the Process Document and, therefore will be evaluated.

5.2.1.1 Overall Protection of Human Health and the Environment. Based on the presence of pentachlorophenol, alternative SS-10 requires that thermal desorption be included for this waste site. The removal/treatment/disposal technologies associated with the thermal desorption enhancement of alternative SS-10 will result in protection of human health and the environment. Any potential additional short-term risk to the workers or the community can be minimized through engineering controls and proper health and safety protocol.

5.2.1.2 Compliance with ARAR. Chemical-specific ARAR for alternative SS-10 will be met by desorption of organic compounds from the soil. Location-specific ARAR can be met through proper planning and scheduling. Action-specific ARAR are met through appropriate design and operation.

5.2.1.3 Long-Term Effectiveness and Permanence. The addition of thermal desorption to alternative SS-10 does not change the analysis of this alternative with respect to this criterion from the Process Document. Contaminated soil exceeding PRG will be permanently removed from the site.

5.2.1.4 Reduction of Toxicity, Mobility, or Volume. Thermal desorption is primarily an irreversible process in which nearly all of the volatile and semivolatile constituents will be reduced. Any remaining volatile and semivolatile organic contaminants will be rendered immobile. Thermal desorption may completely reduce the volume of soil, producing minimal amounts of residuals that will be transferred to a disposal facility.

5.2.1.5 Short-Term Effectiveness. Risks to the community and workers during thermal desorption include potential releases of fugitive gases. These releases can be controlled through vapor abatement and proper operating procedures. No receptors are currently in the area. However, remedial activities can be scheduled to accommodate nesting or roosting species if encountered. All remedial action objectives are met upon completion of remedial alternative.

5.2.1.6 Implementability. No difficulties are anticipated with the implementation of thermal desorption despite the absence of site-specific treatability study data. An influent soil particle size limitation of 6 cm (2 in.) exists. It is very unlikely that technical problems will lead to schedule delays. All necessary equipment and specialists are readily available and adjustments to alternative SS-10 are easily accomplished as thermal desorption will be an off-line process. Due to removal, post closure monitoring will not be required.

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Table 5-1. Waste Site Remedial Alternatives and Technologies.

Alternatives		Technologies Included	Waste Site and Associated Group: 116-B-11 Retention Basin	116-C-5 Retention Basin	100 B/C Buried Pipelines	116-B-1 & 116-C-1 Process Effluent Trenches	116-B-13 & 116-B-14 Sludge Trenches	116-B-4 & 116-B-5 Special Crib [1]	118-B-5, 118-B-7, & 118-B-10 Burial Grounds	132-B-4 & 132-B-5 Demolished Facility	116-B-12 Seal Pit Crib
No Action	SS-1 SW-1	None								P	P
Institutional Controls	SS-2 SW-2	Deed Restrictions									
		Groundwater Monitoring									
Containment	SS-3 SW-3	Surface Water Controls			P			P	P		
		Barrier			P			P	P		
		Deed Restrictions			P			P	P		
		Groundwater Monitoring			P			P	P		
Removal, Disposal	SS-4 SW-4	Removal	P	P	P		P	P	P		
		Disposal	P	P	P		P	P	P		
In Situ Treatment	SS-8A	Surface Water Controls					P	P			
		In Situ Vitrification					P	P			
		Groundwater monitoring					P	P			
		Deed Restrictions					P	P			
	SS-8B	Void Grouting			P						
		Barrier			P						
		Surface Water Controls			P						
		Deed Restrictions			P						
		Groundwater Monitoring			P						
	SW-7	Dynamic Compaction							P		
		Barrier							P		
		Surface Water Controls							P		
		Groundwater Monitoring							P		
		Deed Restrictions							P		
Removal, Treatment, Disposal	SS-10	Removal	P	P	P	P	P	P			
		Thermal Desorption		P							
		Soil Washing	P	P	P	P	P	P			
		Disposal	P	P	P	P	P	P			
	SW-9	Removal							P		
		Thermal Desorption							P		
		Compaction							P		
		ERDF Disposal							P		

Note: [1] 116-B-4 and 116-B-5 are in "Special Crib Group" whose alternatives are consistent with the Dummy Decon Crib / French Drain Group.

P - Indicates the detailed analysis which is provided in the Process Document
O - Indicates the detailed analysis which is provided in the operable unit-specific report
blank - Technology does not apply to this Waste Site
ERDF - Environmental Restoration Disposal Facility

Table 5-2. 100-BC-1 Specific Alternative Costs.

Site	Containment			Removal/Disposal			In Situ Treatment			Removal/Treatment/Disposal		
	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth
100-HR-1 OPERABLE UNIT												
116-H-7 Retention Basin				$29.4M	$0	$28M	$66.9M	$54.9M	$98.0M	$31.9M	$4.05M	$34.2M
116-H-1 Process Effluent Trench				$6.08M	$0	$5.79M				$6.53M	$.825M	$7.02M
116-H-4 Pluto Crib	No interim action proposed at site											
100H PIPELINES	$9.76M	4.64M	$11.9M	$2.27M	$0.0	$2.16M	$.942M	$0.0	$.898M			
132-H-1 Reactor Exhaust Stack	No interim action proposed at site											
132-H-2 Exhaust Air Filter Building	No interim action proposed at site											
132-H-3 Effluent Pumping Station	No interim action proposed at site											

Blank Cell = Not Applicable
O&M = Operation and Maintenance
M = million

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Table 5-3. 100-BC-1 Site-Specific Alternative Durations.

SITE	Containment	Removal/Disposal	In Situ Treatment	Removal/Treatment/Disposal
	Duration (yrs)	Duration (yrs)	Duration (yrs)	Duration (yrs)
100-HR-1 OPERABLE UNIT				
116-H-7 Retention Basin		0.5	8.1	1.0
116-H-1 Process Effluent Trench		0.2		0.2
116-H-4 Pluto Crib	No interim action proposed at site			
100 H PIPELINES	0.5	0.3	0.1	
118-H-5 Burial Ground	Institutional Controls proposed at site			
132-H-1 Reactor Exhaust Stack	No interim action proposed at site			
132-H-2 Exhaust Air Filter Building	No interim action proposed at site			
132-H-3 Effluent Pumping Station	No interim action proposed at site			

Blank Cell = Not Applicable

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6.0 COMPARATIVE ANALYSIS

This section presents the comparative analysis of remedial alternatives that involves evaluation of the relative performance of each alternative compared to the evaluation criteria presented in Section 6.0 of the Process Document. This comparison identifies the advantages and disadvantages of each alternative so that key trade-offs can be identified.

Following the methodology of the Process Document, the comparative analysis of the 100-BC-1 alternatives is presented in quantitative format (Tables 6-1 through 6-6). The tables present the alternatives applicable to each waste site and a comparison of the differences between each alternative. The comparison includes identifying the relative rank of the alternative (relative to other applicable alternatives) along with the cost[1]. The preferred alternative is the alternative which ranks the highest overall for each waste site.

Institutional controls are identified as the only applicable alternative for the 116-B-12 seal pit crib (see Section 5.0 of this document and the Process Document). Because there are no other alternatives to compare against, the site is not included in the comparative analysis. Likewise, the Process Document identifies no action for the D&D group, such as 132-B-4 and 132-B-5. Thus, these sites are also not presented in the following tables.

6.1 QUANTITATIVE COMPARISON OF REMEDIAL ALTERNATIVES

6.1.1 Retention Basins

The Process Document comparative analysis for retention basins ranked Removal/Disposal ahead of Removal/Treatment/Disposal as potential remedial alternatives. When site-specific costs associated with 116-C-5 and 116-B-11 were applied to the comparative analysis in accordance with Table 6-3 of the Process Document, Removal/Disposal still ranked ahead of Removal/Treatment/Disposal. Costs associated with the 116-B-11 resulted in a one-point increase in the total ranking for the Removal/Treatment/Disposal Alternative.

The 116-C-5 retention basin contains pentachlorophenol that will be treated using thermal desorption. The addition of thermal desorption to the treatment process increases the score for the Reduction in Toxicity, Mobility, and Volume through treatment by one point. The additional process slightly reduces the short-term effectiveness, implementability, and cost categories. This reduction is so slight that a reduction in the score originally given to these categories is not warranted. The results of the comparative analysis for the 116-C-5 and 116-B-11 retention basins are shown in Tables 6-1 and 6-2, respectively.

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[1]Estimates of durations for each alternative are presented in Section 5.0, Table 5-3.

6.1.2 Process Effluent Trenches

The Process Document comparative analysis for process effluent trenches ranked the remedial alternatives as follows: Removal/Disposal, Removal/Treatment/Disposal, and In Situ Vitrification. When site-specific costs associated with the 116-C-1 and 116-B-1 process effluent trenches were applied to the comparative analyses in accordance with Table 6-3 of the Process Document, there was no change to the relative ranking of the alternatives. However, the total rank of the Removal/Treatment/Disposal Alternative was reduced by one point. The results are shown in Tables 6-3 and 6-4.

6.1.3 Sludge Trenches

The Process Document comparative analysis for sludge trenches ranked the remedial alternatives as follows: Removal/Disposal, Removal/Treatment/Disposal, and In Situ Vitrification. When site-specific costs associated with the 116-B-13 and 116-B-14 sludge trenches were applied to the comparative analysis in accordance with Table 6-3 of the Process Document, there was no change to the relative rankings of the alternatives.

The cost rank of the Removal/Treatment/Disposal Alternative for 116-B-13 was reduced one point, as was the total rank of the alternative. The cost rank of the Removal/Treatment/Disposal Alternative for 116-B-14 was reduced one point and the cost rank of the In Situ Vitrification alternative was increased one point. The results are shown in Tables 6-5 and 6-6.

6.1.4 Dummy Decontamination Cribs and French Drains

The Process Document comparative analysis for dummy decontamination cribs and French drains ranked the remedial alternatives as follows: Removal/Disposal, Removal/Treatment/Disposal, In Situ Vitrification, and Containment. Site-specific costs associated with the 116-B-4 French drain applied to the comparative analysis in accordance with Table 6-3 of the Process Document changed the relative rankings as follows: Removal/Disposal, Removal/Treatment/Disposal, Containment, and In Situ Vitrification. The change in ranking was because of the relatively low cost of the Containment remedial alternative for 116-B-4.

The 116-B-5 special crib is in the same facility group as the 116-B-4 French drain. Applying the 116-B-5 costs to the comparative analysis in accordance with Table 6-3 of the Process Document resulted in the following ranking: Removal/Disposal, Removal/Treatment/Disposal, Containment, and In Situ Vitrification. The total scores of all but the In Situ Vitrification were very close. The results for 116-B-4 and 116-B-5 are shown in Tables 6-7 and 6-8.

6.1.5 Pipelines

The Process Document comparative analysis for pipelines ranked the remedial alternatives as follows: Removal/Disposal, Removal/Treatment/Disposal, In Situ Grouting, and Containment. When the 100 B/C specific costs were applied to the comparative analysis in accordance with Table 6-3 of the Process Document, the relative rankings of the remedial alternatives were not changed, although the cost rankings changed slightly. The results are shown in Table 6-9.

6.1.6 Burial Grounds

The Process Document comparative analysis of remedial alternatives for burial grounds ranks the alternatives as follows: Removal/Disposal, Removal/Treatment/Disposal, Containment, and In Situ Compaction. When site-specific costs were applied to the comparative analysis in accordance with Table 6-3 of the Process Document, the relative rankings were not changed for the 118-B-7 and 118-B-10 burial grounds. However, the rankings of remedial alternatives for the 118-B-5 burial ground were changed to the following: Containment, Removal/Disposal, Removal/Treatment/Disposal, and In Situ Compaction. The results are shown in Tables 6-10, 6-11, and 6-12.

Table 6-1. Quantitative Comparison of Evaluation Criteria for 116-C-5 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	6.00	3.0
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			31.0			26.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-2. Quantitative Comparison of Evaluation Criteria for 116-B-11 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	9.00
Total Rank[b]			31.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-3. Quantitative Comparison of Evaluation Criteria for 116-C-1 Process Effluent Trench.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	9.00	9.00
Total Rank[b]			29.0			16.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-4. Quantitative Comparison of Evaluation Criteria for 116-B-1 Process Effluent Trench.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	9.00	8.00
Total Rank[b]			29.0			16.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-5. Quantitative Comparison of Evaluation Criteria for 116-B-13 Sludge Trench.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	3.00	3.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	7.00	6.00
Total Rank[b]			29.0			17.0			25.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-6. Quantitative Comparison of Evaluation Criteria for 116-B-14 Sludge Trench.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	3.00	3.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	4.00	1.00	7.00	6.00
Total Rank[b]			29.0			18.0			25.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-7. Quantitative Comparison of Evaluation Criteria for 116-B-5 (Special Crib).

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Vitrification			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.50
Short-Term Effectiveness	0.50	9.00	4.50	0.50	8.00	4.00	0.50	7.00	3.50	0.50	6.00	3.00
Implementability	1.00	6.00	6.00	1.00	8.00	8.00	1.00	3.00	3.00	1.00	6.00	6.00
Cost	10.00	1.00	1.0	1.00	10.00	8.00	1.00	4.00	3.00	1.00	4.00	5.00
Total Rank[b] Score			24.5			28.5			17.0			25.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-8. Quantitative Comparison of Evaluation Criteria for 116-B-4 French Drains.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Vitrification			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.50
Short-Term Effectiveness	0.50	9.00	4.50	0.50	8.00	4.00	0.50	7.00	3.50	0.50	6.00	3.00
Implementability	1.00	6.00	6.00	1.00	8.00	8.00	1.00	3.00	3.00	1.00	6.00	6.00
Cost	1.00	1.00	6.00	1.00	10.00	10.00	1.00	4.00	4.00	1.00	4.00	4.00
Total Rank[b] Score			20.5			30.5			18.0			24.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-9. Quantitative Comparison of Evaluation Criteria for 100 B/C Pipelines.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Grouting			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	2.00	2.00	1.00	7.00	7.00	1.00	3.00	3.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	1.00	0.50	0.50	3.00	1.50	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	6.00	3.00	0.50	6.00	3.00	0.50	4.00	2.00
Implementability	1.00	3.00	3.00	1.00	7.00	7.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	1.00	2.00	1.00	4.00	3.00	1.00	10.00	10.00	1.00	3.00	2.00
Total Rank[b]			11.0			21.5			19.0			20.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-10. Quantitative Comparison of Evaluation Criteria for 118-B-10 Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	9.00	1.00	10.00	10.00	1.00	6.00	8.00	1.00	9.00	7.00
Total Rank[b]			22.5			25.0			20.5			22.5

Table 6-11. Quantitative Comparison of Evaluation Criteria for 118-B-7 Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	4.00	1.00	10.00	10.00	1.00	6.00	3.00	1.00	9.00	3.00
Total Rank[b]			17.5			25.0			15.5			18.5

Table 6-12. Quantitative Comparison of Evaluation Criteria for 118-B-5 Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	10.00	1.00	10.00	8.00	1.00	6.00	9.00	1.00	9.00	7.00
Total Rank[b]			23.5			23.0			21.5			22.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

7.0 COMPARATIVE ANALYSIS FOR NEW REMEDIATION CONCEPT

As discussed in the introduction, the detailed analysis and comparative analysis performed in Sections 5.0 and 6.0 above were based on the baseline scenario described in the Process Document. The Sensitivity Analysis and New Remediation Concept (Appendix D) evaluated several different land use scenarios and resulted in a modification to the baseline scenario. This new remediation concept is discussed in detail in Appendix D and establishes regulatory bases for protection of human health, ecological protection, groundwater protection, and surface water protection. An evaluation of the effects of this new remediation concept on the analysis presented in the Process Document was performed in Appendix D. The impacts of this new remediation concept that effect the work performed in this FFS Appendix are as follows:

- In Situ Vitrification (ISV) and Containment are no longer alternatives that can be used for the waste sites evaluated in this FFS because they preclude potential future sue of the areas impacted by the waste site.

- The magnitude of excavation (predominantly depth) has been reduced, thus reducing cost by 32% and 30% for Remove/Dispose and Remove/Treat/Dispose Alternatives, respectively.

- The relative effects on the key discriminators that are used to evaluate and compare the alternatives are similar for both Remove/Dispose and Remove/Treat/Dispose.

7.1 BC-1 FFS IMPACTS

The prior discussions relating to the application of the plug-in approach, alternative development, and detailed analysis of alternatives are all still directly applicable to the new remediation concept. The fundamental changes due to the new remediation concept (ISV and containment eliminated and reduction in extent of excavation) do not adversely affect the process or results of the plug-in approach. No new deviations to the plug-in approach have been identified, and thus, no new alternative development is required. The Remove/Dispose and Remove/Treat/Dispose detailed analysis generated in the Process Document and Section 5.0 of this attachment are changed only minimally from the reduced extent of excavation. The risk, impacts, and adverse effects of the Remove/Dispose and Remove/Treat/Dispose Alternatives on workers, human health, and the environment are similar and do not warrant a change to the detailed evaluation. The comparative analysis, however, requires elimination of the ISV and containment alternatives and require a recalculation of cost scoring. This difference in the reduction in costs is minimal and should not change the scores for these two alternatives.

7.2 NEW REMEDIATION CONCEPT COMPARATIVE ANALYSIS

7.2.1 116-C-5 and 116-B-11 Retention Basins

The Remove/Dispose and Remove/Treat/Dispose Alternatives are the only alternatives applicable to these retention basins. The scoring and ranking as applied in the Process Document and in this FFS Appendix are still valid, except for costs. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, changes the score of the 116-C-5 cost category to 10 and 7, respectively. The reduction in excavation does not change the relative advantages and disadvantages of the alternatives. The comparative analysis tables based on the new remediation concept for 116-C-5 are given in Table 7-1 and for 116-B-11 are given in Table 7-2.

7.2.2 116-C-1 and 116-B-1 Process Effluent Trenches

With the elimination of ISV as an alternative for the 116-C-1 and 116-B-1 process effluent trenches, now only the Remove/Dispose and Remove/Treat/Dispose Alternatives are applicable to these waste sites. The scoring and ranking as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, resulted in no changes to the score of the cost category. The results are provided in Tables 7-3 and 7-4.

7.2.3 116-B-13 and 116-B-14 Sludge Trenches

With the elimination of ISV, the 116-B-13 and 116-B-14 sludge trenches were evaluated only for Remove/Dispose and Remove/Treat/Dispose. The scoring and ranking, as applied in the Process Document and Section 6.0 of this FFS, are still valid. The cost reduction factors discussed above resulted in no changes to the score of the cost category. The overall ranking of alternatives is provided in Tables 7-5 and 7-6.

7.2.4 116-B-4 French Drain

With the elimination of the ISV and containment alternatives, the Remove/Dispose and Remove/Treat/Dispose Alternatives are the only alternatives applicable to the 116-B-4 French Drain. The scoring and ranking as applied in the Process Document and in this FFS Appendix are still valid except for costs. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, resulted in no changes to the score of the cost category. The reduction in excavation does not change the relative advantages and disadvantages of the alternatives. The comparative analysis table, based on the new remediation concept for 116-B-4, is given in Table 7-7.

7.2.5 116-B-5 Special Crib

With the elimination of ISV and containment as an alternative for the 116-B-5 special crib, now only the Remove/Dispose and Remove/Treat/Dispose Alternatives are applicable to this waste site. The scoring and ranking as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost. The cost reduction of 32% and 30% for

Remove/Dispose and Remove/Treat/Dispose, respectively, changes the score of the cost category to 10 and 7, respectively. The results are provided in Table 7-8.

7.2.6 100-B/C Buried Pipelines

With the elimination of the ISV and containment alternatives for the 100 B/C Buried Pipelines, Remove/Dispose and Remove/Treat/Dispose are the only viable alternatives to be considered. The scoring and ranking, as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost. The cost reduction factors discussed above for Remove/Dispose and Remove/Treat/Dispose changes the score of the cost categories to 10 and 8, respectively. The results are provided in Table 7-9.

7.2.7 100-BC Burial Grounds

With the elimination of ISV and containment, Remove/Dispose and Remove/Treat/Dispose are the only alternatives to be considered. The scoring and ranking, as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost, where the 118-B-10 Burial Bround cost score changed to a 10 and a 7 for Remove/Dispose and Remove/Treat/Dispose, respectively. The results for the comparison of alternatives for the 118-B-10, 118-B-7, and 118-B-5 burial grounds are shown in Tables 7-10, 7-11, and 7-12.

Table 7-1. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-C-5 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[b]			31.0			25.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-2. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-11 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[(a)]	Weight	Score	Rank[(a)]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	9.00
Total Rank[(b)]			31.0			27.0

[(a)]Rank = weight x score
[(b)]Total Rank = sum of individual rankings

Table 7-3. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-C-1 Process Effluent Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	9.00	9.00
Total Rank[b]			29.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-4. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-1 Process Effluent Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[(a)]	Weight	Score	Rank[(a)]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[(b)]			29.0			26.0

[(a)]Rank = weight x score
[(b)]Total Rank = sum of individual rankings

Table 7-5. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-13 Sludge Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	6.00	6.00
Total Rank[b]			29.0			25.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-6. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-14 Sludge Trench.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	3.00	3.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	4.00	1.00	6.00	6.00
Total Rank[b]			29.0			18.0			25.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-7. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-4 French Drain.

CERCLA Evaluation Criteria	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[(a)]	Weight	Score	Rank[(a)]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.50
Short-Term Effectiveness	0.50	8.00	4.00	0.50	6.00	3.00
Implementability	1.00	8.00	8.00	1.00	6.00	6.00
Cost	1.00	10.00	10.00	1.00	4.00	4.00
Total Rank[(b)] Score			30.5			24.5

[(a)]Rank = weight x score
[(b)]Total Rank = sum of individual rankings

Table 7-8. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-B-5 (Special Crib).

CERCLA Evaluation Criteria	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[(a)]	Weight	Score	Rank[(a)]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.50
Short-Term Effectiveness	0.50	8.00	4.00	0.50	6.00	3.00
Implementability	1.00	8.00	8.00	1.00	6.00	6.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[(b)] Score			30.5			27.5

[(a)]Rank = weight x score
[(b)]Total Rank = sum of individual rankings

Table 7-9. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 100 B/C Pipelines.

CERCLA Evaluation Criteria	**Removal/Disposal**			**Removal/Treatment/Disposal**		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.50	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	4.00	2.00
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			28.5			26.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-10. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-B-10 Burial Grounds.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	3.00	1.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	3.00	3.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[b]			25.0			22.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-11. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-B-7 Burial Grounds.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	4.00	1.00	10.00	10.00	1.00	6.00	3.00	1.00	9.00	3.00
Total Rank[b]			17.5			25.0			15.5			18.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-12. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-B-5 Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	10.00	1.00	10.00	8.00	1.00	6.00	9.00	1.00	9.00	7.00
Total Rank[b]			23.5			23.0			21.5			22.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

8.0 REFERENCES

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ATTACHMENT 1

100-BC-1 OPERABLE UNIT WASTE SITE VOLUME ESTIMATES

Volume Estimate
100-BC-1 Operable Unit

OBJECTIVE:

Provide estimates of:

- The volume of contaminated materials within high priority waste sites in the 100-BC-1 Operable Unit.
- The volume of materials that will need to be excavated to remove the contaminated materials.
- The areal extent of contamination.

Estimates are provided for the following waste sites:

Site Number	Site Name	Page
116-B-1	107-B Liquid Waste Disposal Trench	F-93
116-B-5	108-B Crib	F-95
116-C-5	107-C Retention Basin	F-97
116-C-1	107-C Liquid Waste Disposal Trench	F-99
116-B-11	107-B Retention Basin	F-101
116-B-13	107-B South Sludge Trench	F-103
116-B-14	107-B North Sludge Trench	F-105
116-B-4	105-B Dummy Decon French Drain	F-107
116-B-12	117-B Crib	F-109
132-B-4	117-B Filter Building	F-110
132-B-5	115-B/C Gas Recirculation Building	F-111
118-B-5	Ball 3X Burial Ground	F-112
118-B-7	111-B Solid Waste Burial Ground	F-114
118-B-10	Pit/Burial Ground	F-116
Pipelines	Effluent Pipelines (soil and sludge)	F-118
Pipelines	Pipeline Leak at B/C Junction Box	F-119

Volume Estimate
100-BC-1 Operable Unit

METHOD:

The following steps are used to calculate volumes and areas for each waste site:

- Estimate the dimensions of each waste site.
- Estimate the location of the site.
- Estimate the extent of contamination present at each site.
- Estimate the extent of the excavation necessary to remove the contamination present.
- Calculate the volume of contamination present, the volume of material to be removed, and the areal extent of contamination.

Waste Site Dimensions -
Dimensions of the waste site are derived from all pertinent references. The reference used is noted in brackets [].

Waste Site Location -
Location of the waste site is derived from pertinent references confirmed by field visit. The specific reference or method used to locate each site is discussed in a separate brief [7]. Coordinates for each waste site are converted to Washington State coordinates [8]. Resulting Washington State coordinates are presented herein.

Contaminated Volume Dimensions -
The extent of contamination present at the waste site is estimated from analytical data that exists for the site (references 5 and 6). The data used, assumptions made, and method for estimating extent is discussed in a separate brief [9]. Dimensions are summarized herein.

Excavated Volume Dimensions -
The extent of the excavation necessary to remove the contamination is based on a 1.5 H : 1.0 V excavation slope with the extent of contamination at depth serving as the bottom of the excavation.

Volume and Area Calculations -
The above information is used to construct a digital terrain model of each site within the computer program AutoCad. The computer program DCA is then used to calculate volumes and areas for the waste site.

ASSUMPTIONS:

The following assumptions were used to locate and/or provide dimensions for a waste site if no other data exists. See reference 9 for assumptions concerning extent of contamination and reference 7 for assumptions concerning location of the waste site.

Volume Estimate
100-BC-1 Operable Unit

ASSUMPTIONS (continued):

Burial Grounds -

- Burial ground dimensions are 20 ft wide at the bottom, 20 ft deep, and have 1.0 H : 1.0 V side slopes.
- Five feet of additional cover was provided.
- Burial grounds were completely filled.

Liquid Waste Sites -

- Trenches were built with 1.0 H : 1.0 V side slopes.
- Tops of cribs are 6 ft below grade.

The following assumptions were used in calculating volumes and areas:

- No site interferences or overlaps are considered, volumes and areas are calculated for each waste site separately.
- 1.5 H: 1.0 V side slopes assumed for excavation.

All depths are below grade unless noted.

REFERENCES:

1. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1991, *Hanford Site Waste Information Data System (WIDS)*, Richland, Washington.

2. Hanford Site Drawings and Plans.

3. Site topographic maps, Drawings H-13-000100 to H-13-000106.

4. Historical photographs of the 100-B/C Area.

5. Dorian, J.J., and V.R. Richards, *Radiological Characterization of the Retired 100 Areas*, UNI-946, May 1978, United Nuclear Industries, Richland, Washington.

6. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1993, *Limited Field Investigations Report for the 100-BC-1 Operable Unit*, DOE-RL-93-06, March 1993, U.S. Department of Energy, Richland, Washington.

7. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1993, *Limited Field Investigations Report for the 100-BC-5 Operable Unit*, DOE-RL-93-97, June 1993, U.S. Department of Energy, Richland, Washington.

8. IT Corporation, 1993, "100-B/C Waste Site Locations", IT Corporation Calculation Brief. Project Number 199806.317.

Volume Estimate
100-BC-1 Operable Unit

REFERENCES (continued):

9. IT Corporation, 1993, "100-B/C Area Volume Estimate", IT Corporation Calculation Brief. Project Number 199806.317.

10. IT Corporation, 1993, "100-BC-1 Waste Site Contaminated Extent" IT Corporation Calculation Brief. Project Number 199806.407.

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-1
SITE NAME: 107-B Liquid Waste Disposal Trench

WASTE SITE DIMENSIONS:

Length - 114.3 m (375 ft) along top, 108.2 m (355 ft) along bottom [4]
Width - 9.1 m (30 ft) along bottom, 15.2 m (50 ft) at surface [4]
Depth - 4.6 m (15 ft) [1]. Sandy gravel fill extends to a depth of about 6.4 m (21 ft) below grade, 1.8 m (6 ft) below trench bottom [6]
Slopes - 1.0 H : 1.5 V [9]
Orientation - Long axis oriented N 45 E [2]

Waste site has been backfilled to the surface [3]. Backfill is considered uncontaminated.

CONTAMINATED VOLUME DIMENSIONS:

Trench was filled with liquids to an average level of 10 ft above base, side slopes and substrate are contaminated to a depth of 5 ft (1.5 m) below the trench bottom) [10]. No lateral contamination extends from the edges of the trench [9].

Length - 112.2 m (368 ft); 2.0 m (6.7 ft) SW and NE from bottom edge of site
Width - 13.1 m (43 ft); 2.0 m (6.7 ft) NW and SE from bottom edge of site
Depth - 6.1 m (20 ft) below grade, 1.5 m (5 ft) below base of trench

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 112.2 m (368 ft) x 13.1 m (43 ft) at a depth of 6.1 m (20 ft) [10]
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,340
Easting: 565,583

Reference Point: Northeast corner at surface

ELEVATIONS:

Surface: 134.1 m (440 ft) [3]
Groundwater: 119.5 m (392 ft) [7]

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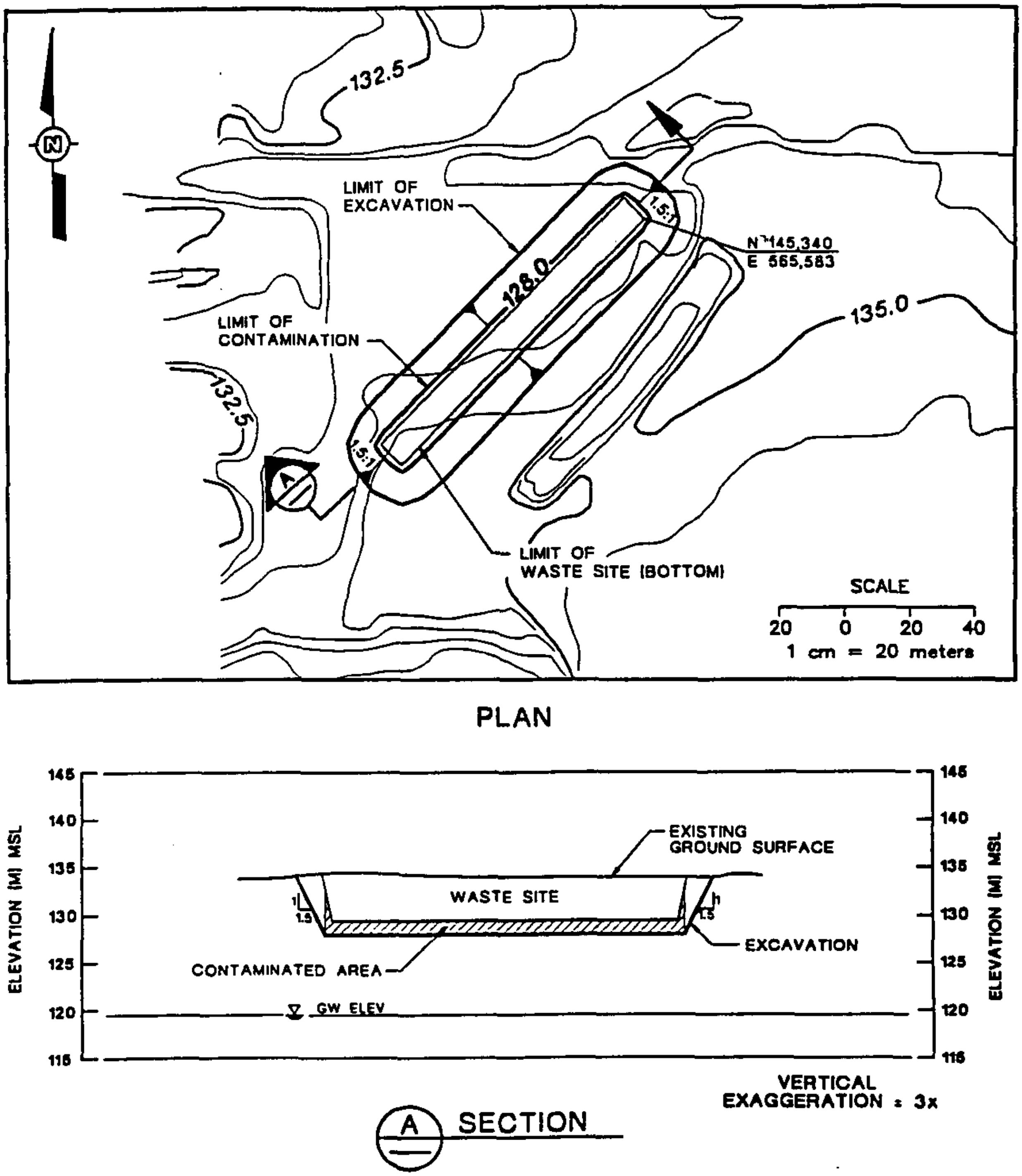
Figure 1. IRM Site: 116-B-1.

Figure A-1 IRM Site: 116-B-1



EXTENT OF CONTAMINATION

SURFACE AREA = 1,470 sq. meters
VOLUME = 3,001 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 4,007 sq. meters
VOLUME = 16,263 cu. meters

116B1

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-5
SITE NAME: 108-B Crib

WASTE SITE DIMENSIONS:

Length - 25.6 m (84 ft) along bottom [1]
Width - 4.9 m (16 ft) along bottom [1]
Depth - 3.5 m (11.5 ft) [6]
Slopes - 1.0 H : 1.0 V
Orientation - Long axis oriented N-S [2]

Waste site contains layers of boiler ash, concrete, void space and sandy gravel fill [6].

CONTAMINATED VOLUME DIMENSIONS:

Data indicate that contamination has spread to 2.6 m (8.5 ft) below the base of the site [10]. No lateral contamination is assumed to exist beyond top dimensions of site [10].

Length - 29 m (95 ft); 1.7 m (5.5 ft) beyond each end of the bottom of site
Width - 8.2 m (27 ft); 1.7 m (5.5 ft) beyond each side of the bottom of site
Depth - 4.3 m (14 ft); from 1.8 m (6 ft) to 6.1 m (20 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 29 m (95 ft) x 8.2 m (27 ft) at a depth of 6.1 m (20 ft)
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 144,768
Easting: 565,318

Reference Point: Center of waste site

ELEVATIONS:

Surface: 140.5 m (461 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

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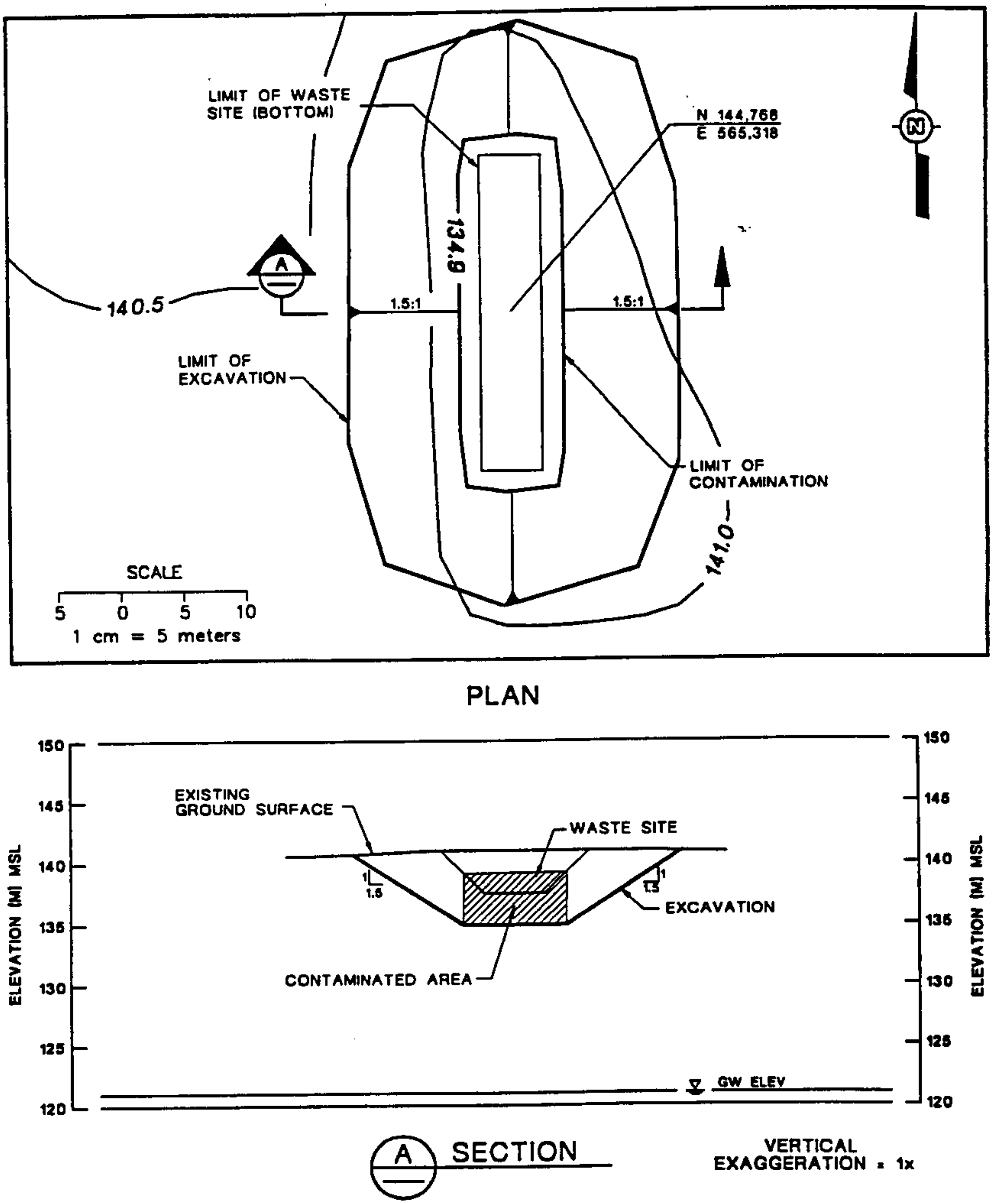
Figure 2. IRM Site: 116-B-5.

Figure A-2 IRM Site: 116-B-5



EXTENT OF CONTAMINATION

SURFACE AREA = 232 sq. meters
VOLUME = 1,022 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,066 sq. meters
VOLUME = 3,763 cu. meters

116B5

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-C-5
SITE NAME: 107-C Retention Basin

WASTE SITE DIMENSIONS:

Diameter - 100.6 m (330 ft) each tank [1]
Depth - Tanks sit on grade, walls are 4.9 m (16 ft) high [1]
Slopes - Vertical walls [2]

Waste site consists of two carbon steel tanks with a series of baffle plates inside. Tanks have been backfilled with 3 ft of soil [6].

CONTAMINATED VOLUME DIMENSIONS:

Data indicate that contamination has spread laterally up to 12.2 m (40 ft) from the edges of the tank [10].

Diameter - 12.2 m (40 ft) from edge of each tank
Depth - 6.1 m (20 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation will be an additional 12.2 m (40 ft) radius around tank at a depth of 6.1 m (20 ft)
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing:	145,110	Northing:	145,110
Easting:	565,390	Easting:	565,493

Reference Point: Center of W tank. Reference Point: Center of E tank

ELEVATIONS:

Surface: 132.3 m (434 ft) [3]
Groundwater: 120.4 m (395 ft) [7]

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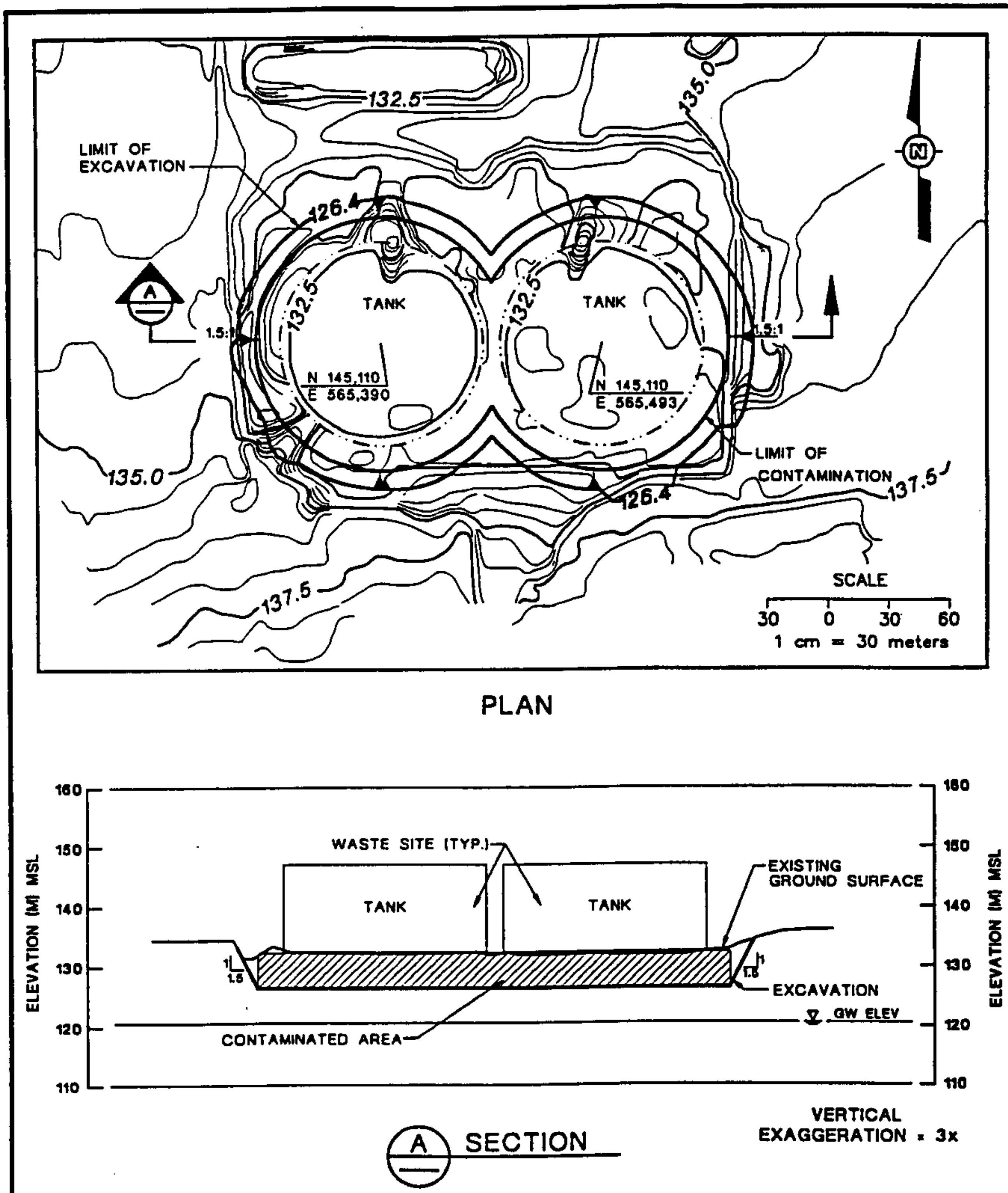
Figure 3. IRM Site: 116-C-5.

Figure A-3 IRM Site: 116-C-5



EXTENT OF CONTAMINATION

SURFACE AREA = 23,805 sq. meters
VOLUME = 145,210 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 30,628 sq. meters
VOLUME = 160,667 cu. meters

116C5

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-C-1
SITE NAME: 107-C Liquid Waste Disposal Trench

WASTE SITE DIMENSIONS:

Length - 152.4 m (500 ft) along bottom, 175.3 m (575 ft) at surface [1,2]
Width - 15.2 m (50 ft) along bottom, 38.1 m (125 ft) at surface [1,2]
Depth - 7.6 m (25 ft) [1]
Slopes - 1.5 H : 1.0 V [2]
Orientation - Long axis oriented N 75 E [2]

Waste site has been backfilled to the surface [3].

CONTAMINATED VOLUME DIMENSIONS:

Contamination extends from 1.8 m (6 ft) to 7.6 m (25 ft) below grade. Contamination is within the top dimension of the trench.

Length - 169.8 m (557 ft)
Width - 32.6 m (107 ft)
Depth - 5.8 m (19 ft)

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 169.8 m (557 ft) x 32.6 m (107 ft) at a depth of 7.6 m (25 ft)
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for surface dimensions.

WASTE SITE LOCATION:

Northing: 145,363
Easting: 565,794

Reference Point: Center of SW bottom site edge.

Northing: 145,303
Easting: 565,939

Reference Point: Center of NE bottom site edge

ELEVATIONS:

Surface: 133.2 m (437 ft) [3]
Groundwater: 119.5 m (392 ft) [7]

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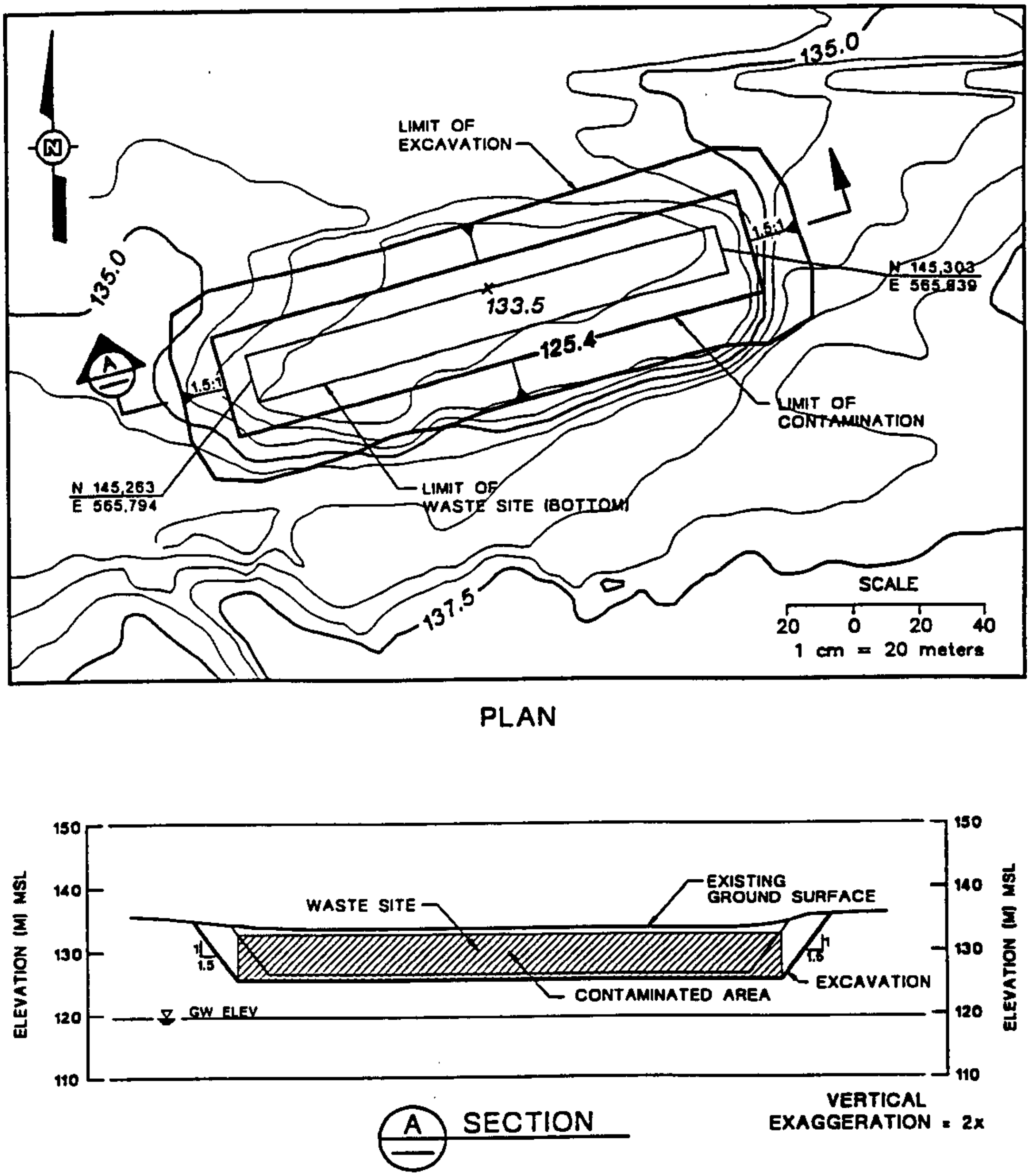
Figure 4. IRM Site: 116-C-1.

Figure A-4 IRM Site: 116-C-1



EXTENT OF CONTAMINATION

SURFACE AREA = 5,535 sq. meters
VOLUME = 31,441 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 11,475 sq. meters
VOLUME = 69,048 cu. meters

116C1

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-11
SITE NAME: 107-B Retention Basin

WASTE SITE DIMENSIONS:

Length - 143.3 m (470 ft) [2]
Width - 70.1 m (230 ft) [1,2]
Depth - 1.5 m (5 ft) [5]
Slopes - Vertical [2]
Orientation - Long axis oriented E-W [2]

Waste site has been backfilled with 4 ft of fill [5]. Backfill is considered contaminated.

CONTAMINATED VOLUME DIMENSIONS:

Data indicate that contamination has spread laterally up to 41.1 m (135 ft) north and 33.5 m (110 ft) east, and west of the site boundaries [10].

Length - 210.3 m (690 ft); 33.5 m (110 ft) from E and W edge of site
Width - 111.3 m (365 ft); 41.1 m (135 ft) N from edge of site
Depth - 6.1 m (20 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 210.3 m (690 ft) x 111.3 m (365 ft) at a depth of 6.1 m (20 ft) below grade.
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,298
Easting: 565,464

Reference Point: Northeast corner of waste site

ELEVATIONS:

Surface: 130.2 m (427 ft) [3]
Groundwater: 119.5 m (392 ft) [7]

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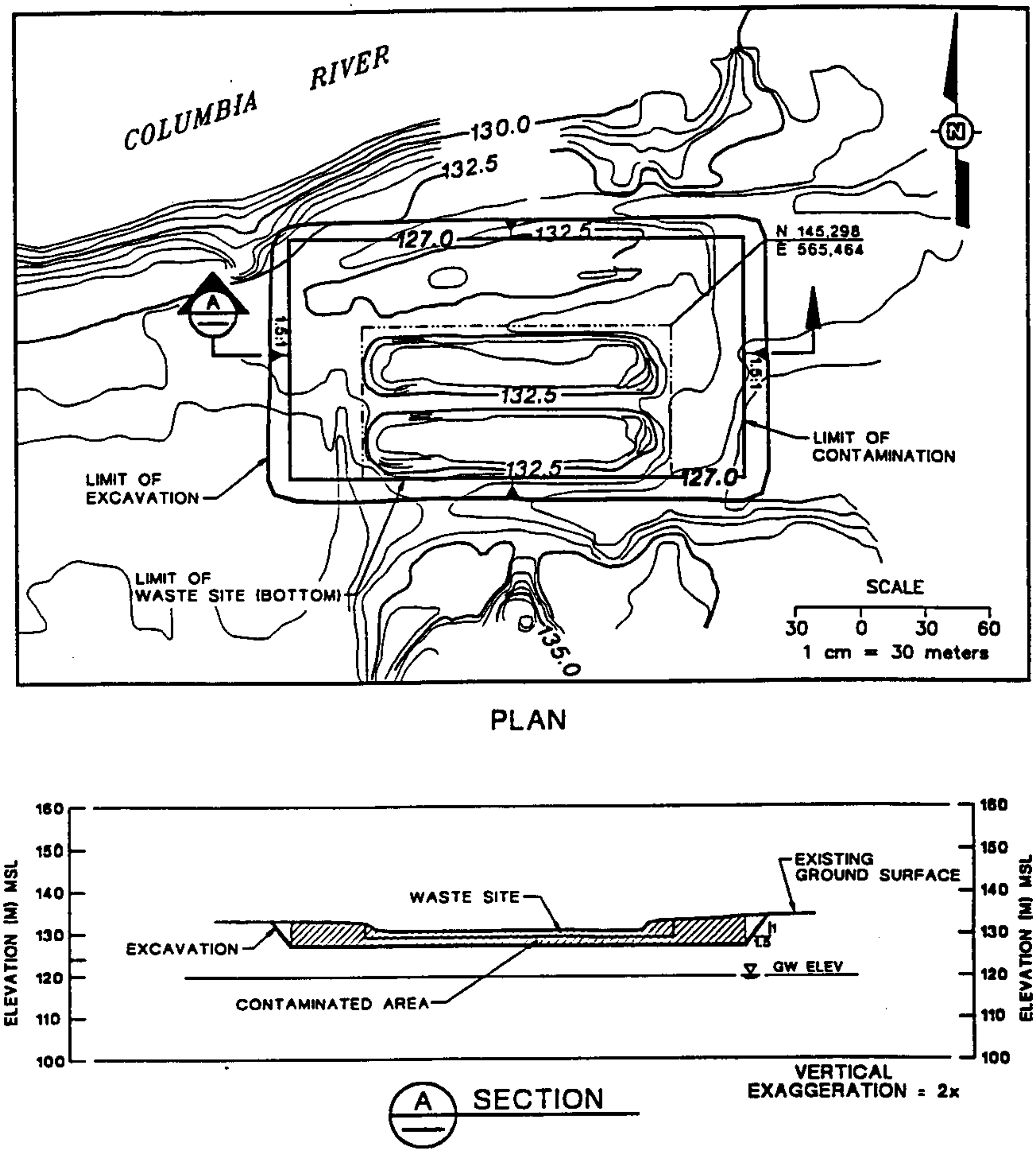
Figure 5. IRM Site: 116-B-11.

Figure A-5 IRM Site: 116-B-11



EXTENT OF CONTAMINATION

SURFACE AREA = 23,406 sq. meters
VOLUME = 118,835 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 29,849 sq. meters
VOLUME = 144,366 cu. meters

116B11

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-13
SITE NAME: 107-B South Sludge Trench

WASTE SITE DIMENSIONS:

Length - 15.2 m (50 ft) [1]
Width - 15.2 m (50 ft) [1]
Depth - 3.0 m (10 ft) [1]
Slopes - Vertical [2].
Orientation - Oriented N-S [2]

Sludge trench has been covered with 1.8 m (6 ft) of soil [1].

CONTAMINATED VOLUME DIMENSIONS:

It is assumed that contamination has spread to 0.9 m (3 ft) below the base of the site [10]. No lateral contamination is assumed to exist [10].

Length - 15.2 m (50 ft)
Width - 15.2 m (50 ft)
Depth - 4.0 m (13 ft); from 1.8 m (6 ft) to 5.8 m (19 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 15.2 m (50 ft) x 15.2 m (50 ft) at a depth of 5.8 m (19 ft)
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,218
Easting: 565,461

Reference Point: Northeast corner of waste site

ELEVATIONS:

Surface: 134.1 m (440 ft) [3]
Groundwater: 120.1 m (394 ft) [7]

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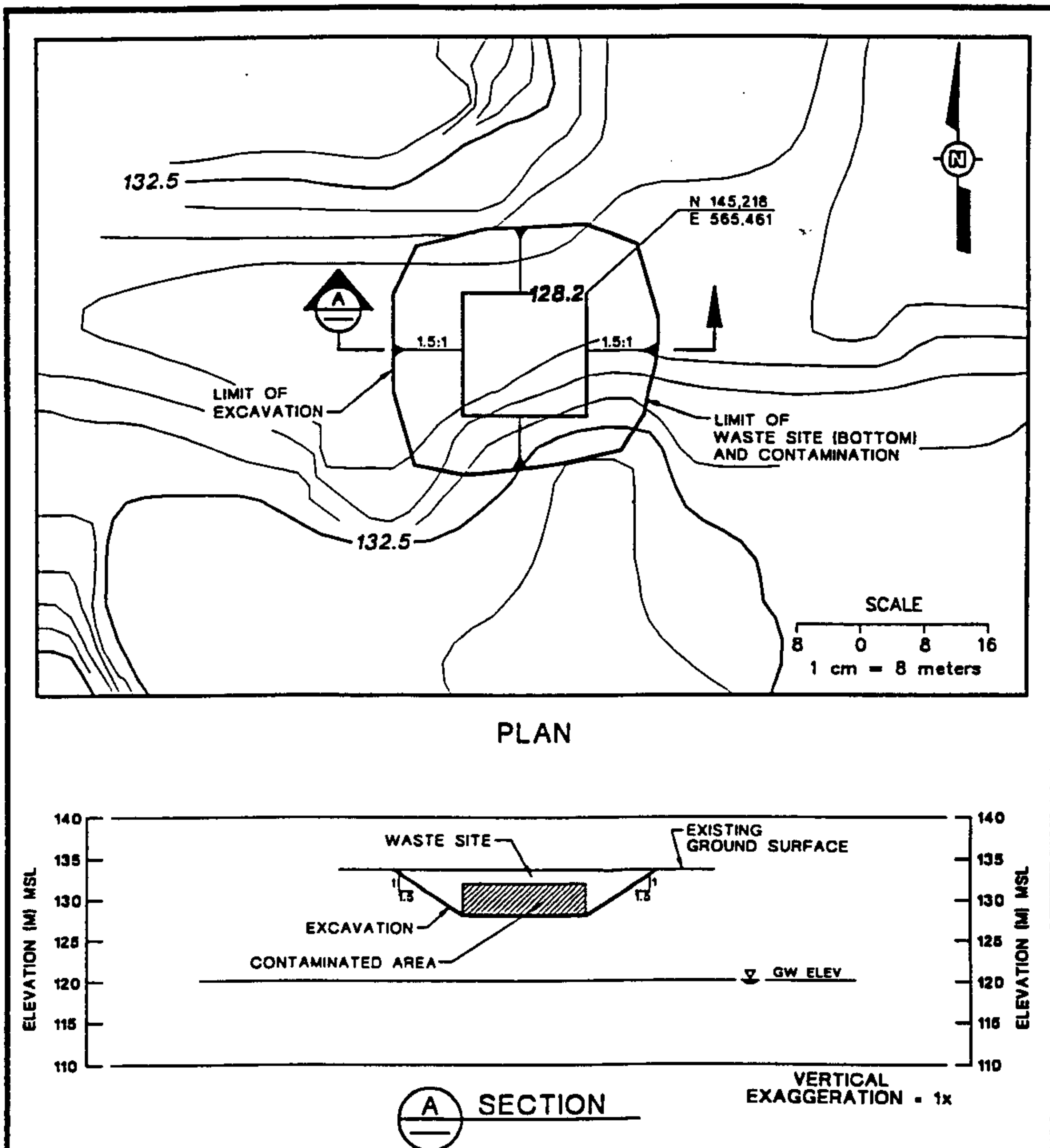
Figure 6. IRM Site: 116-B-13.

Figure A-6 IRM Site: 116-B-13



EXTENT OF CONTAMINATION

SURFACE AREA = 228 sq. meters
VOLUME = 924 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 879 sq. meters
VOLUME = 2,927 cu. meters

116B13

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-14
SITE NAME: 107-B North Sludge Trench

WASTE SITE DIMENSIONS:

Length - 36.6 m (120 ft) [1]
Width - 3.0 m (10 ft) [1]
Depth - 3.0 m (10 ft) [1]
Slopes - Vertical [9]
Orientation - Long axis oriented E-W [2]

Sludge trench has been covered with 1.8 m (6 ft) of soil [1].

CONTAMINATED VOLUME DIMENSIONS:

It is assumed that contamination has spread to 3 ft (0.9 m) below the base of the site [10]. No lateral contamination is assumed to exist [10].

Length - 36.6 m (120 ft)
Width - 3.0 m (10 ft)
Depth - 4.0 m (13 ft) from 1.8 m (6 ft) to 5.8 m (19 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 36.6 m (120 ft) x 3 m (10 ft) at a depth of 5.8 m (19 ft) below grade
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,328
Easting: 565,410

Reference Point: Northeast corner of waste site

ELEVATIONS:

Surface: 134.1 m (440 ft) [3]
Groundwater: 120.1 m (394 ft) [7]

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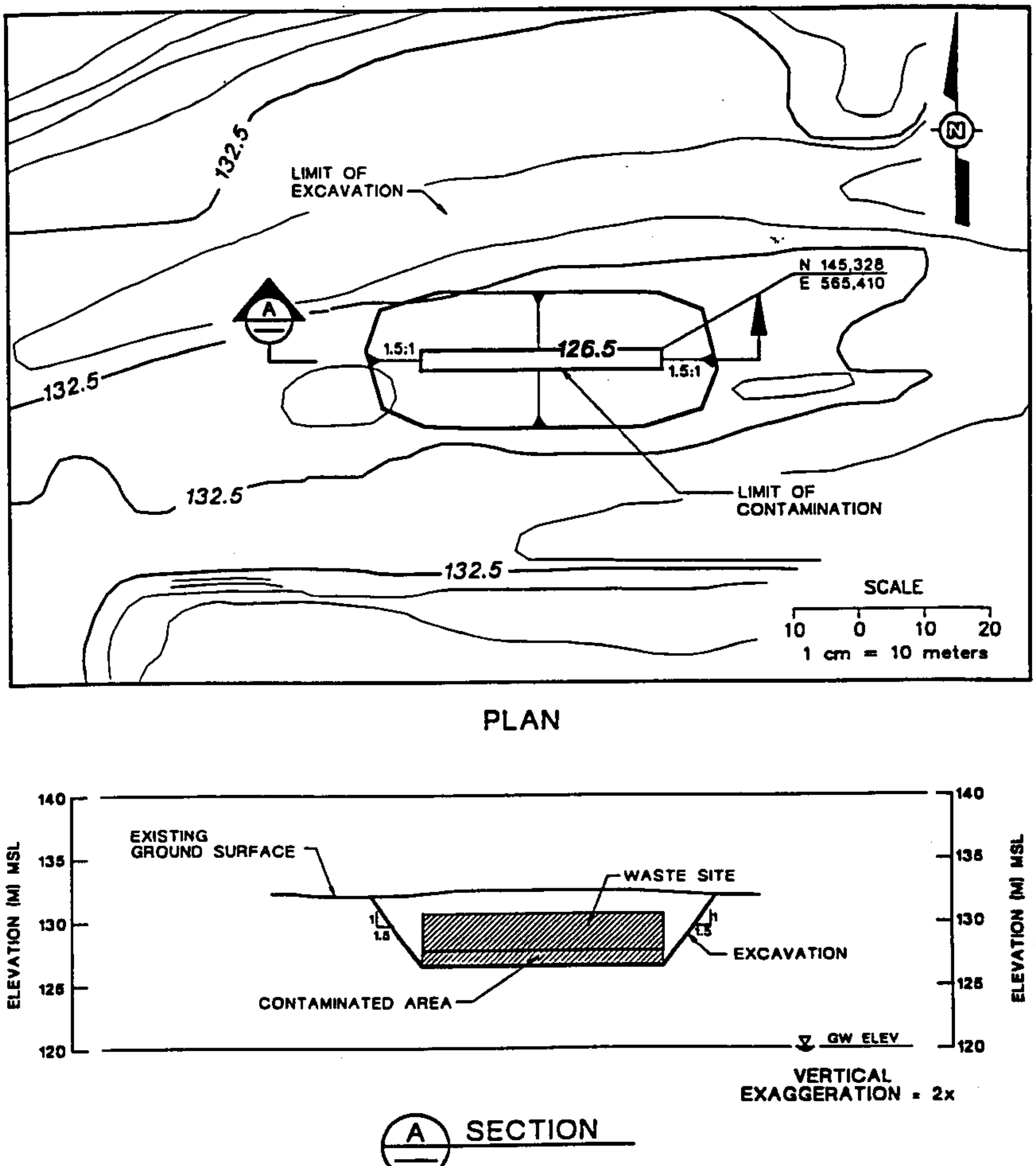
Figure 7. IRM Site: 116-B-14.

Figure A-7 IRM Site: 116-B-14



EXTENT OF CONTAMINATION

SURFACE AREA = 110 sq. meters
VOLUME = 439 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,011 sq. meters
VOLUME = 3,106 cu. meters

116B14

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-4
SITE NAME: 105-B Dummy Decontamination French Drain

WASTE SITE DIMENSIONS:

Diameter - 1.2 m (4 ft) [1]
Depth - 6.1 m (20 ft) [1]
Slopes - Vertical walls [2]

Waste site has a graded rock and sand bottom [1]. The site has been backfilled to the surface [9].

CONTAMINATED VOLUME DIMENSIONS:

It is assumed that contamination is within the confines of the site [10]. No lateral contamination exists [10].

Diameter - 1.2 m (4 ft)
Depth - 2.7 m (9 ft); from 1.8 m (6 ft) to 4.6 m (15 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 1.2 m (4 ft) in diameter at a depth of 4.6 m (15 ft) below grade
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 144,523
Easting: 565,359

Reference Point: Center of waste site

ELEVATIONS:

Surface: 143.0 m (469 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

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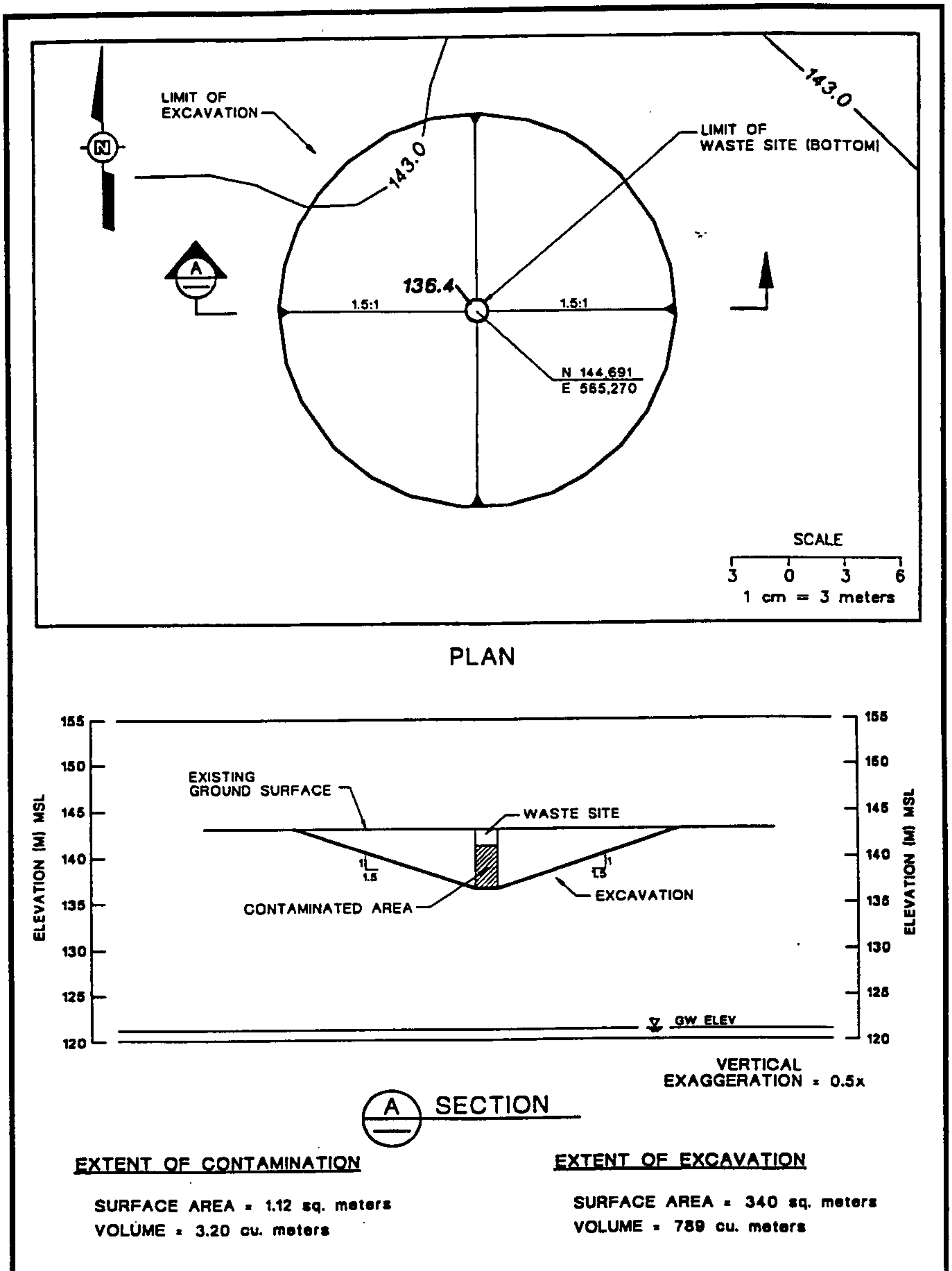
Figure 8. IRM Site: 116-B-4.

Figure A-8 IRM Site: 116-B-4



116B4

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 116-B-12
SITE NAME: 117-B Crib

WASTE SITE DIMENSIONS:

Length - 3 m (10 ft) [1]
Width - 3 m (10 ft) [1]
Depth - 3 m (10 ft) [5]
Slopes - Vertical [9]
Orientation - Oriented N-S [2]

The crib was backfilled to grade with soil after use [6]. Top of crib is 1.8 m (6 ft) below land surface.

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 144,447
Easting: 565,387

Reference Point: Center of waste site

ELEVATIONS:

Surface: 144.5 m (474 ft) [3]
Groundwater: 121.0 m (397 ft) [7].

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 132-B-4
SITE NAME: 117-B Filter Building

WASTE SITE DIMENSIONS:

Length - 18.0 m (59 ft) [1]
Width - 11.9 m (39 ft) [1]
Depth - 8.2 m (27 ft) [1]
Slopes - Vertical [9]
Orientation - Long axis oriented E-W [2]

The top of the existing structure is 0.9 m (3 ft) below grade and is covered with clean backfill [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 144,458
Easting: 565,290

Reference Point: NW corner of waste site.

ELEVATIONS:

Surface: 143.9 m (472 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 132-B-5
SITE NAME: 115-B/C Gas Recirculation Building

WASTE SITE DIMENSIONS:

Length - 51.2 m (168 ft) [1]
Width - 25.9 m (85 ft) [1]
Depth - 3.4 m (11 ft) [1]
Slopes - Vertical [9]
Orientation - Long axis oriented E-W [2]

The top of the existing structure is 0.9 m (3 ft) below grade and is covered with clean backfill [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 144,441
Easting: 565,344

Reference Point: Northeast corner of waste site

ELEVATIONS:

Surface: 143.9 m (472 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 118-B-5
SITE NAME: Ball 3X Burial Ground

WASTE SITE DIMENSIONS:

Site is L-shaped with bottom dimensions from the SW corner 22 x 22 x 8 x 14 x 14 x 8.2 m (72 x 72 x 26 x 46 x 46 x 27 ft)
Depth - 6.1 m (20 ft) [1]
Slopes - 1.0 H : 1.0 V [9].
Orientation - Oriented N-S [2]

Waste site has been covered with 1.5 m (5 ft) (mounded) of overburden [1]. Overburden is considered uncontaminated.

CONTAMINATED VOLUME DIMENSIONS:

No contamination extends beyond the limits of the site [9].

Contaminated dimensions are equal to waste site dimensions.

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,395
Easting: 565,368

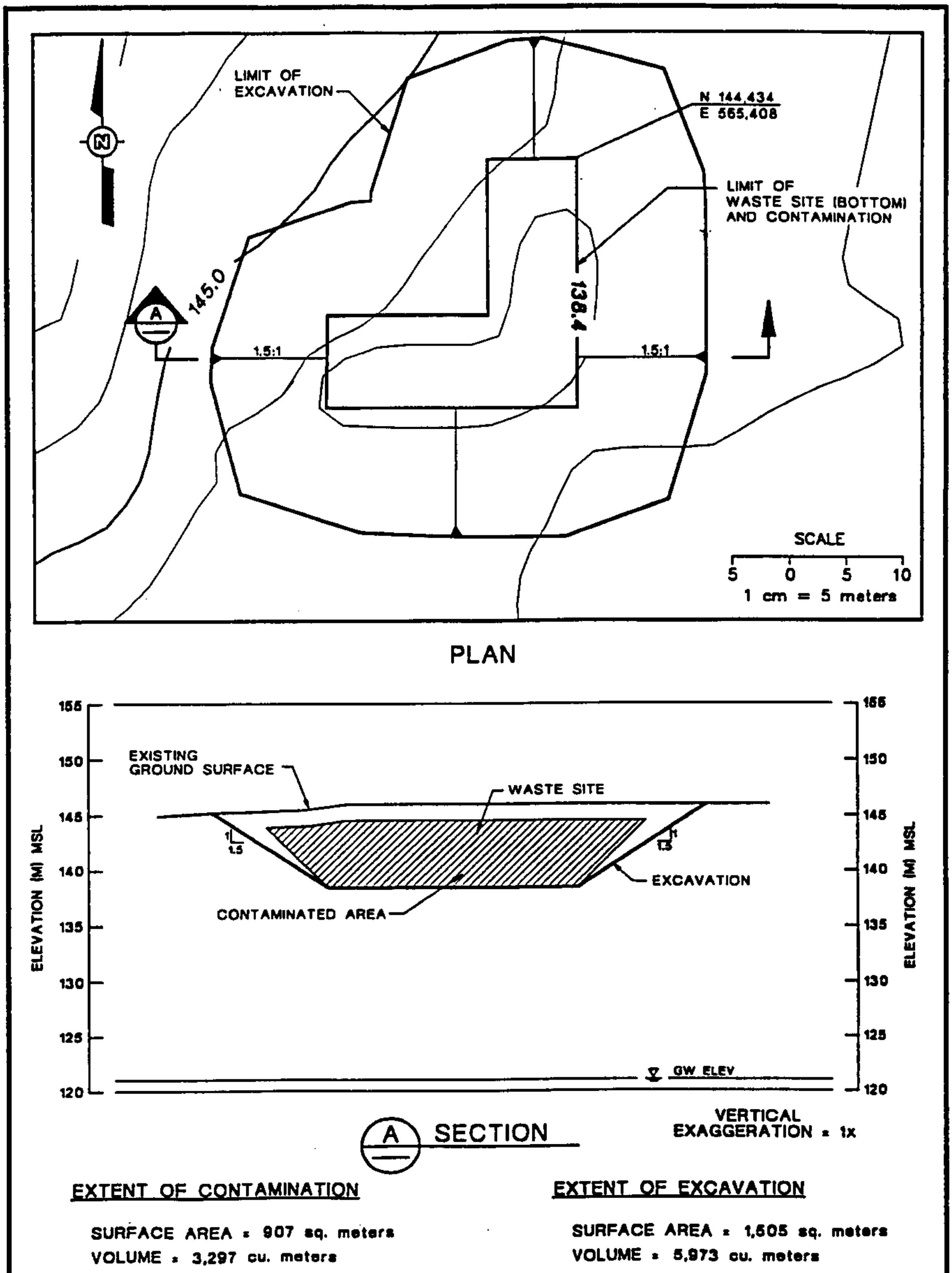
Reference Point: NW corner at surface

ELEVATIONS:

Surface: 145.1 m (476 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

Figure 9. IRM Site: 118-B-5.

Figure A-9 IRM Site: 118-B-5



118B5

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 118-B-7
SITE NAME: 111-B Solid Waste Burial Ground

WASTE SITE DIMENSIONS:

Length - 2.4 m (8 ft) along bottom [1]; 7.3 m (24 ft) along top [10]
Width - 2.4 m (8 ft) along bottom [1]; 7.3 m (24 ft) along top [10]
Depth - 2.4 m (8 ft) [1]
Slopes - 1.0 H : 1.0 V [9]
Orientation - Oriented N-S [2]

Waste site has been covered with 1.5 m (5 ft) (mounded) of backfill [1]. Backfill is considered uncontaminated.

CONTAMINATED VOLUME DIMENSIONS:

No contamination extends beyond the limits of the site [9]

Length - 2.4 m (8 ft) along bottom; 7.3 m (24 ft) along top
Width - 2.4 m (8 ft) along bottom; 7.3 m (24 ft) along top
Depth - 2.4 m (8 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 2.4 m (8 ft) x 2.4 m (8 ft) at a depth of 2.4 m (8 ft) below grade (excluding overburden).
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,359
Easting: 565,379

Reference Point: Northeast corner at surface

ELEVATIONS:

Surface: 145.1 m (476 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

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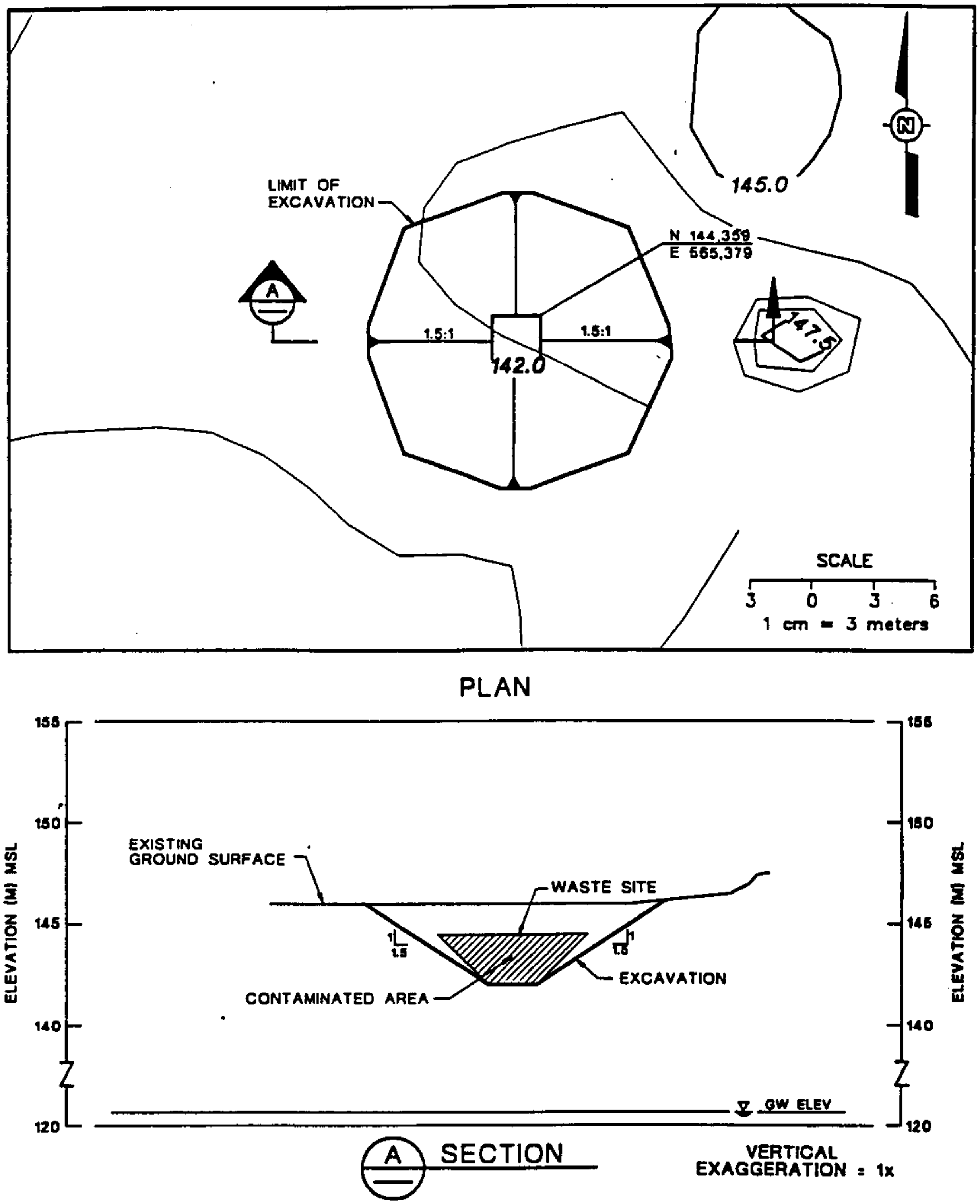
Figure 10. IRM Site: 118-B-7.

Figure A-10 IRM Site: 118-B-7



EXTENT OF CONTAMINATION

SURFACE AREA = 46 sq. meters
VOLUME = 61 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 164 sq. meters
VOLUME = 268 cu. meters

118B7

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: 118-B-10
SITE NAME: Pit/Burial Ground

WASTE SITE DIMENSIONS:

Length - 14.6 m (48 ft) along bottom [1]; 26.8 m (88 ft) along top [10]
Width - 5.6 m (18 ft) along bottom [1]; 17.7 m (58 ft) along top [10]
Depth - 6.1 m (20 ft)
Slopes - 1.0 H : 1.0 V [9]
Orientation - Oriented E-W [2]

Waste site has been covered with 2.4 m (8 ft) (0.9 m [3 ft] mounded) of backfill [1]. Backfill is considered uncontaminated.

CONTAMINATED VOLUME DIMENSIONS:

No contamination extends beyond the limits of the site [9].

Length - 14.6 m (48 ft) along bottom; 26.8 m (88 ft) along top
Width - 5.5 m (18 ft) along bottom; 17.7 m (58 ft) along top
Depth - From 2.4 m (8 ft) to 8.5 m (28 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 14.6 m (48 ft) x 5.6 m (18 ft) at a depth of 8.5 m (28 ft)
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 145,477
Easting: 565,320

Reference Point: Northeast corner at bottom

ELEVATIONS:

Surface: 143.9 m (472 ft) [3]
Groundwater: 121.0 m (397 ft) [7]

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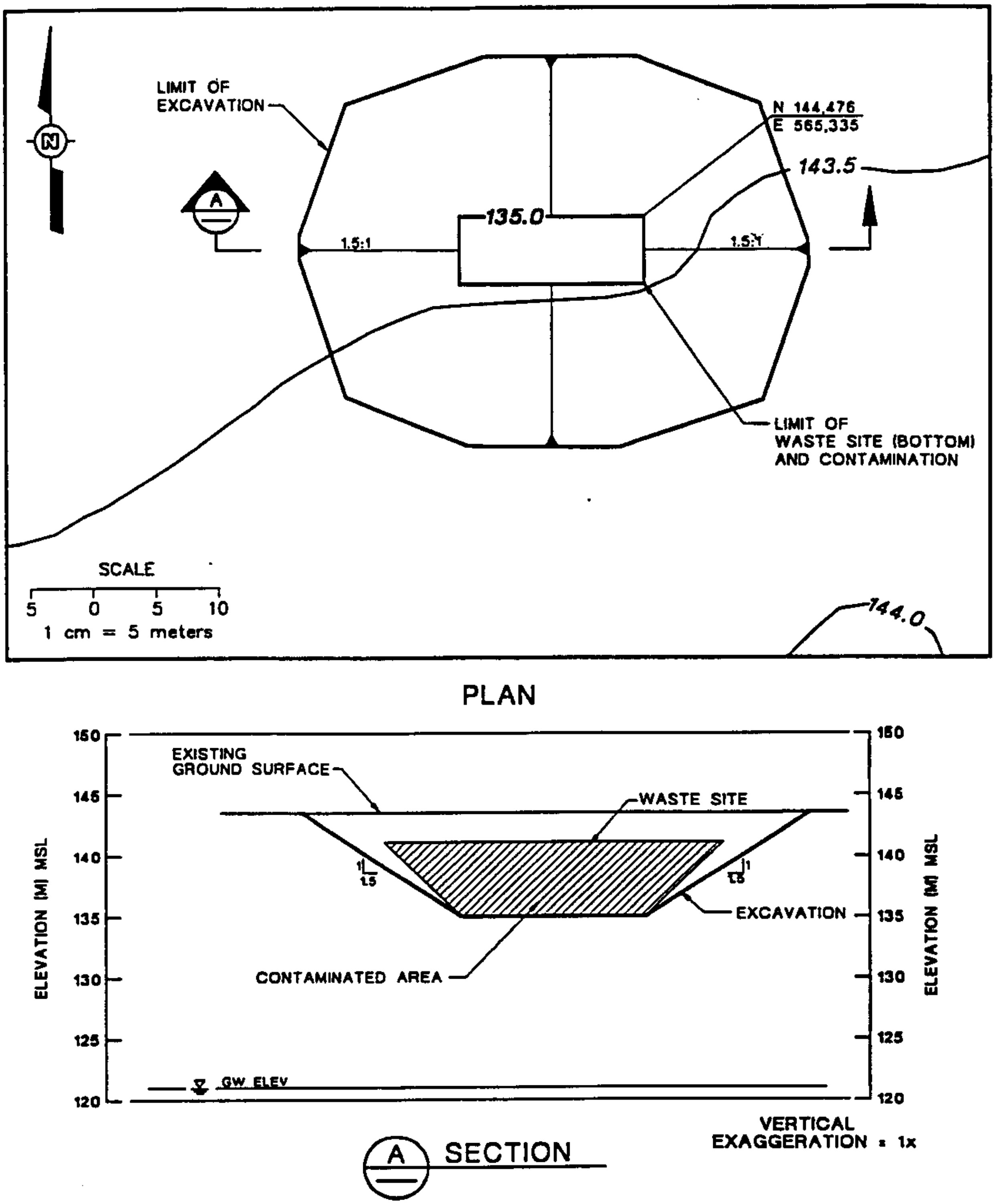
Figure 11. IRM Site: 118-B-10.

Figure A-11 IRM Site: 118-B-10



EXTENT OF CONTAMINATION

SURFACE AREA = 402 sq. meters
VOLUME = 1,346 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,045 sq. meters
VOLUME = 4,054 cu. meters

118B10

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER:
SITE NAME: Effluent Pipelines (soil and sludge)

WASTE SITE DIMENSIONS:

Length - 3,246 m (10,650 ft) [2]
Width - 1.7 m (66 in) [2]
Length - 1,494 m (4,900 ft) [2]
Width - 1.5 m (60 in) [2]
Length - 134 m (440 ft) [2]
Width - 1.4 m (54 in) [2]
Length - 716 m (2,350 ft) [2]
Width - 1.2 m (48 in) [2]

Length - 320 m (1,050 ft) [2]
Width - 1.1 m (42 in) [2]
Length - 463 m (1,520 ft) [2]
Width - .6 m (24 in) [2]
Length - 160 m (524 ft) [2]
Width - .5 m (18 in) [2]

CONTAMINATED VOLUME DIMENSIONS:

Soil around pipe. See Pipeline Leak at B/C Junction Box.

Sludge inside pipe. All pipes have contaminated sludge along bottom. Volume of sludge is insignificant, the volume calculated will be that of pipe void.

EXCAVATED VOLUME DIMENSIONS:

Depends on depth of pipe. Base of excavation is 0.6 m (2 ft) on each side of the pipe and begins 3 inches below invert of pipe.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

See figure.

ELEVATIONS:

See figure.

Volume Estimate
100-BC-1 Operable Unit

SITE NUMBER: N/A
SITE NAME: Pipeline Leak at B/C Junction Box

WASTE SITE DIMENSIONS:

The contamination is associated with a leak around a 54" steel pipeline and the associated junction box leading to the 116-C-5 Retention Basins [5].

Assume pipeline is in a gravel bed 3 in. below, 6 in. above and 2 ft on either side of the pipe. Assume top of gravel bed is 15 ft below grade.

Pipeline is in a trench with 1 H : 1 V side slopes.

CONTAMINATED VOLUME DIMENSIONS:

Assume contamination has spread throughout the gravel bed and then downward below the site.

Length - 76.2 m (250 ft)
Width - 5.8 m (19 ft)
Depth - 3 m (10 ft); from 4.6 m (15 ft) to 7.6 m (25 ft) below grade

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 76.2 m (250 ft) x 5.8 m (19 ft) at a depth of 7.6 m (25 ft) below grade.
Excavation Slopes - 1.5 H : 1.0 V
See attached figure for excavation top dimensions.

WASTE SITE LOCATION:

Northing: 144,551
Easting: 565,440

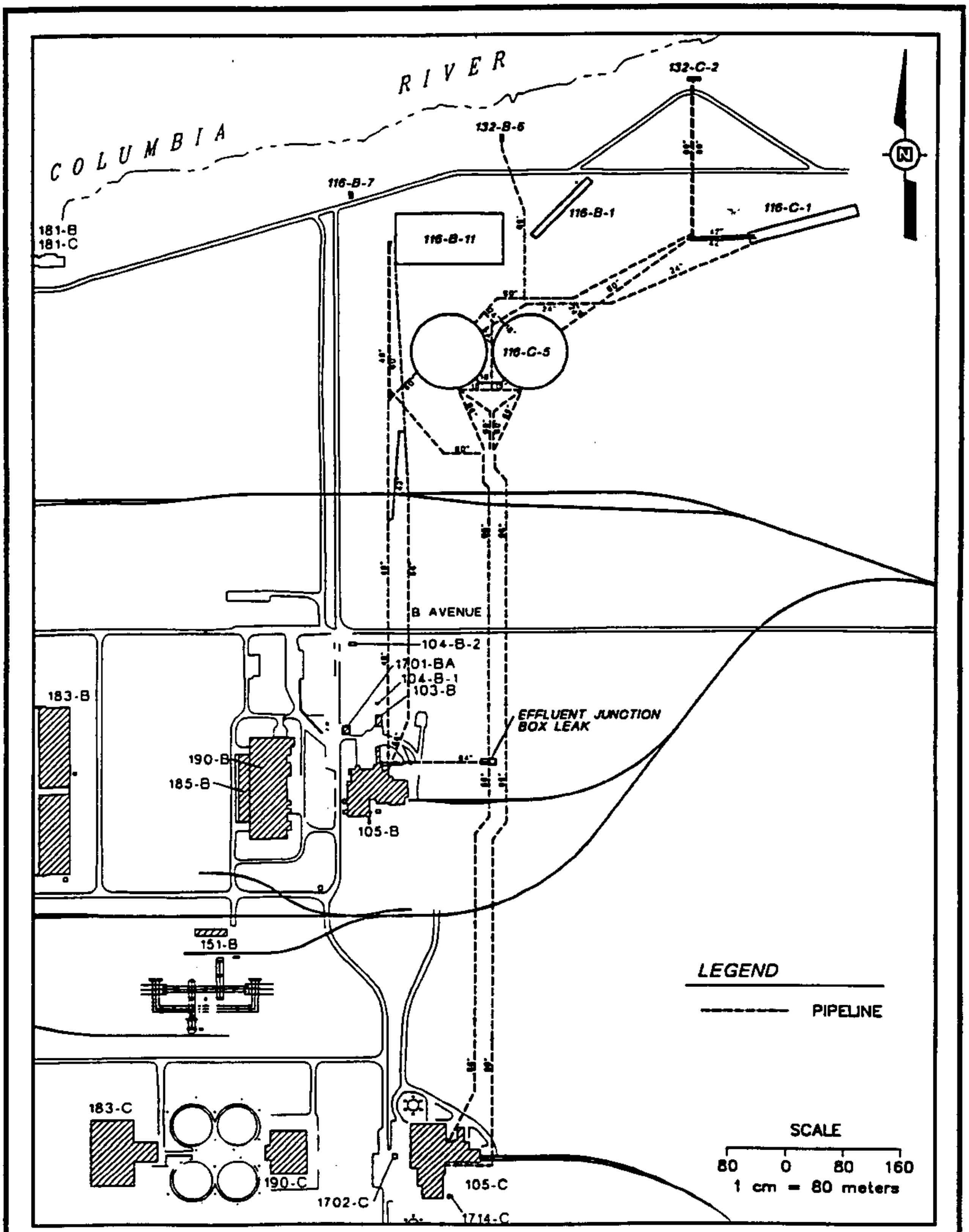
Reference Point: Junction Box

ELEVATIONS:

Surface: 142 m (466 ft) [10]
Groundwater:

Figure 12. IRM Site: 100 B/C Pipelines.

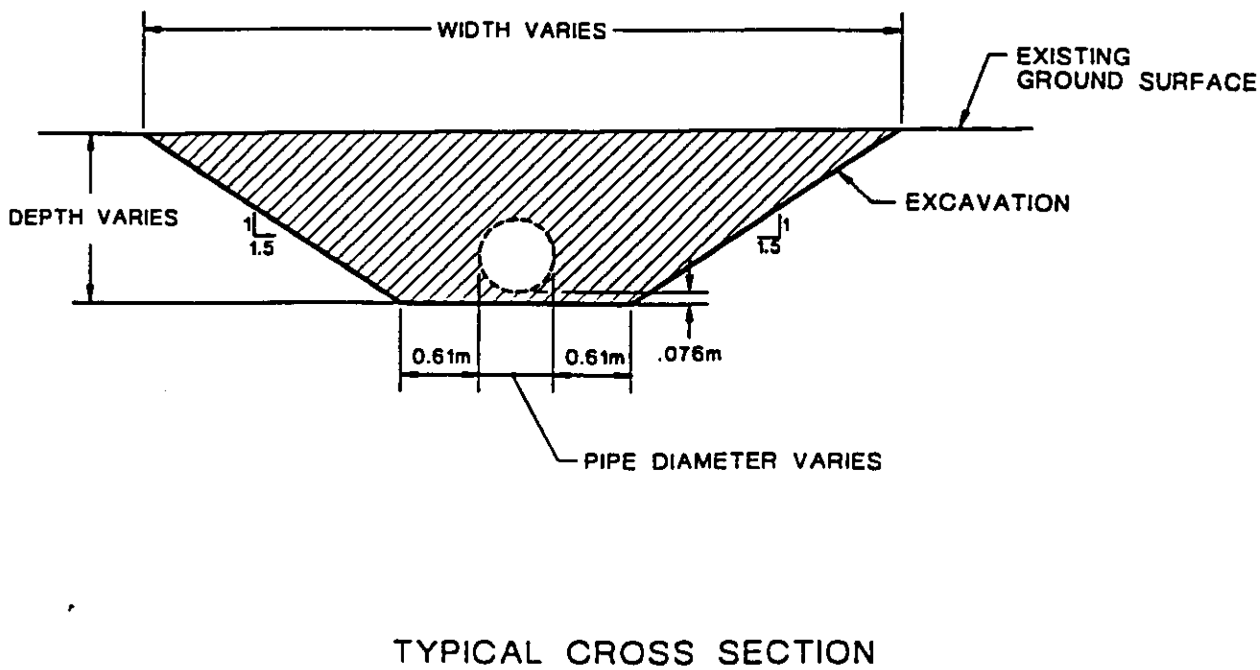
Figure A-12 IRM Site: 100 B/C Pipelines



100BCPLN

Figure 13. Typical Pipeline Excavation Cross Section.

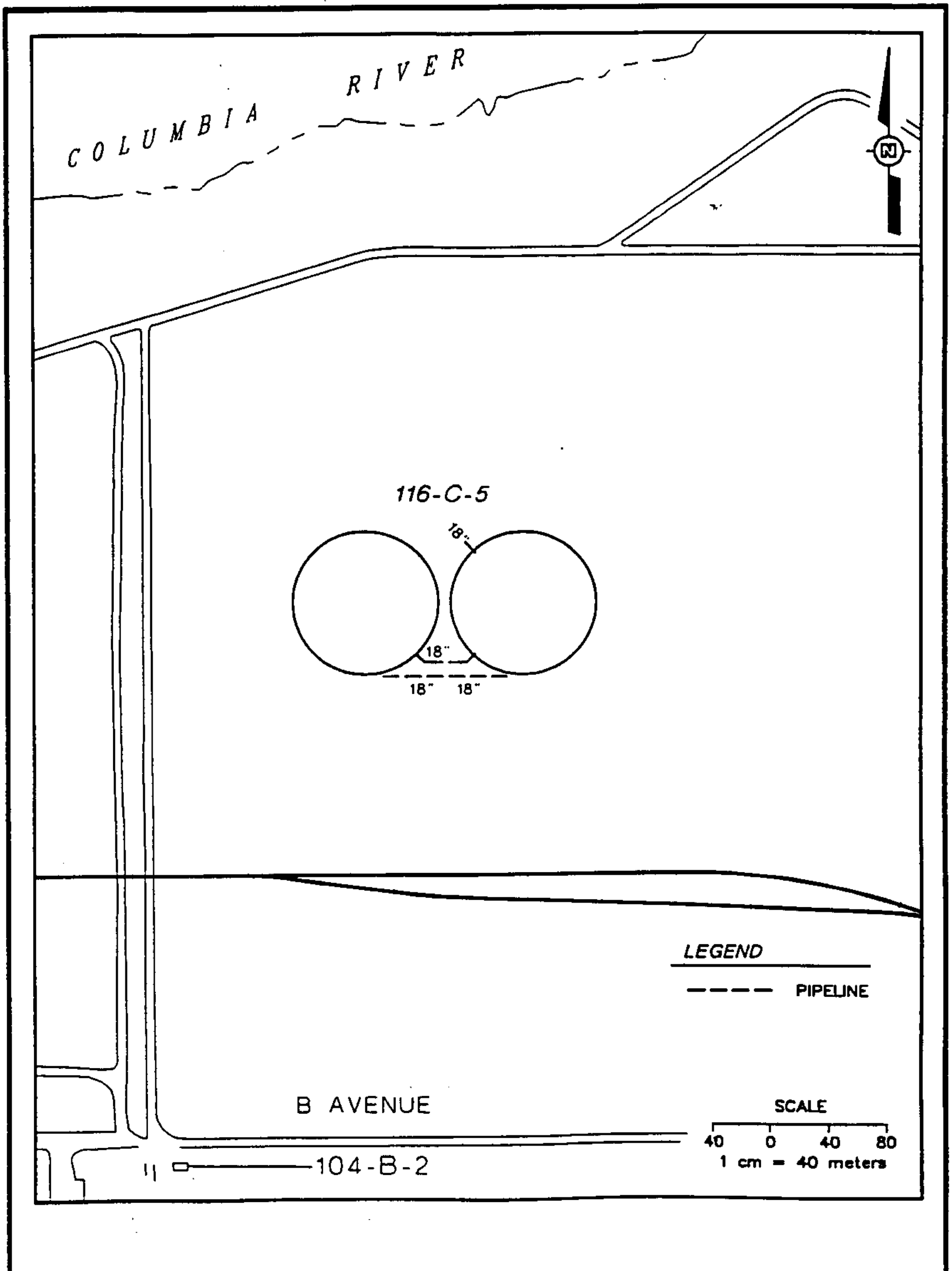
Figure A-13 Typical Pipeline Excavation Cross Section



PEXSEC

Figure 14. 100 B/C 18 inch Pipelines.

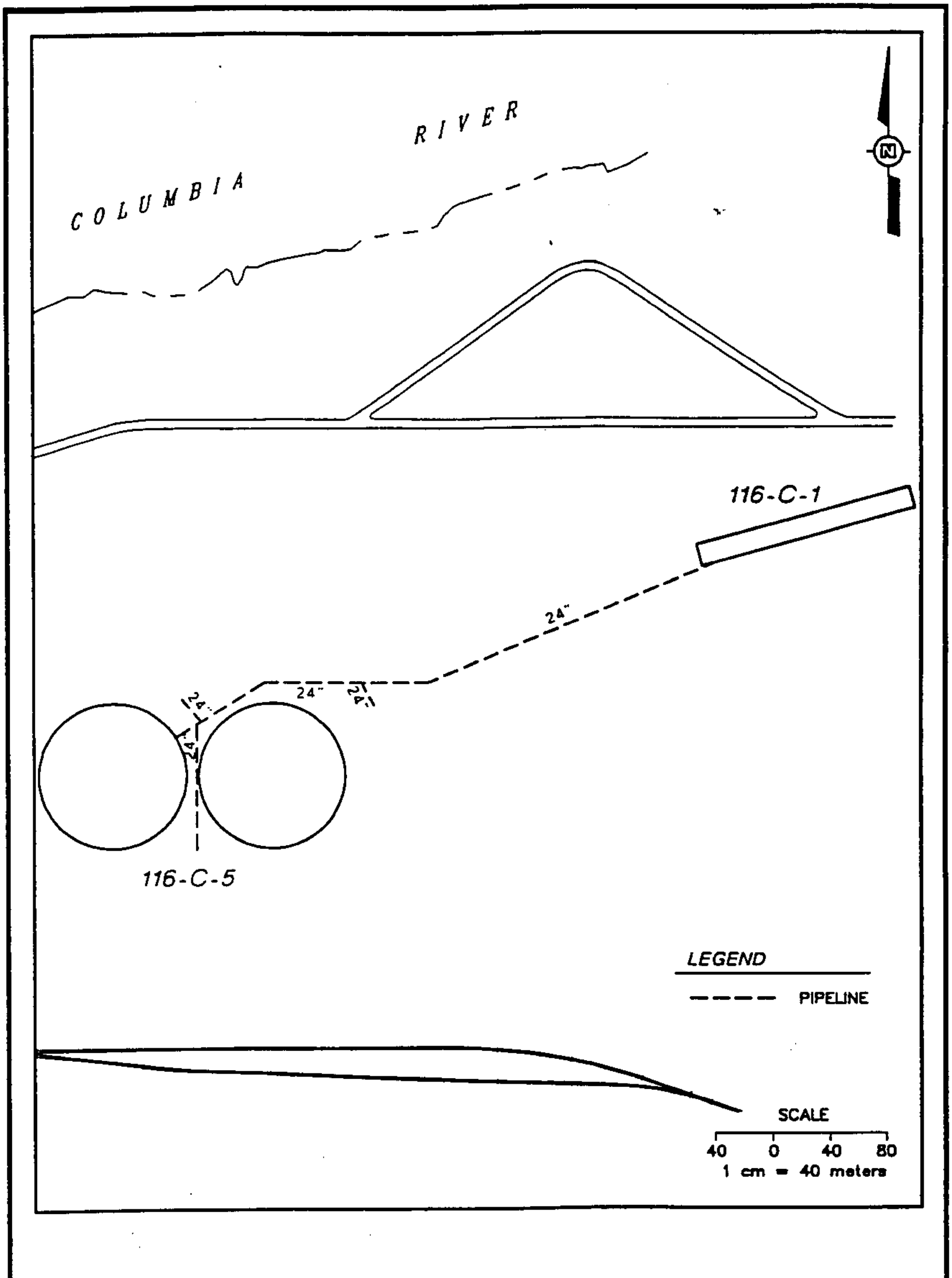
Figure A-14 100 B/C 18 inch Pipelines



PLN18

Figure 15. 100 B/C 24 inch Pipelines.

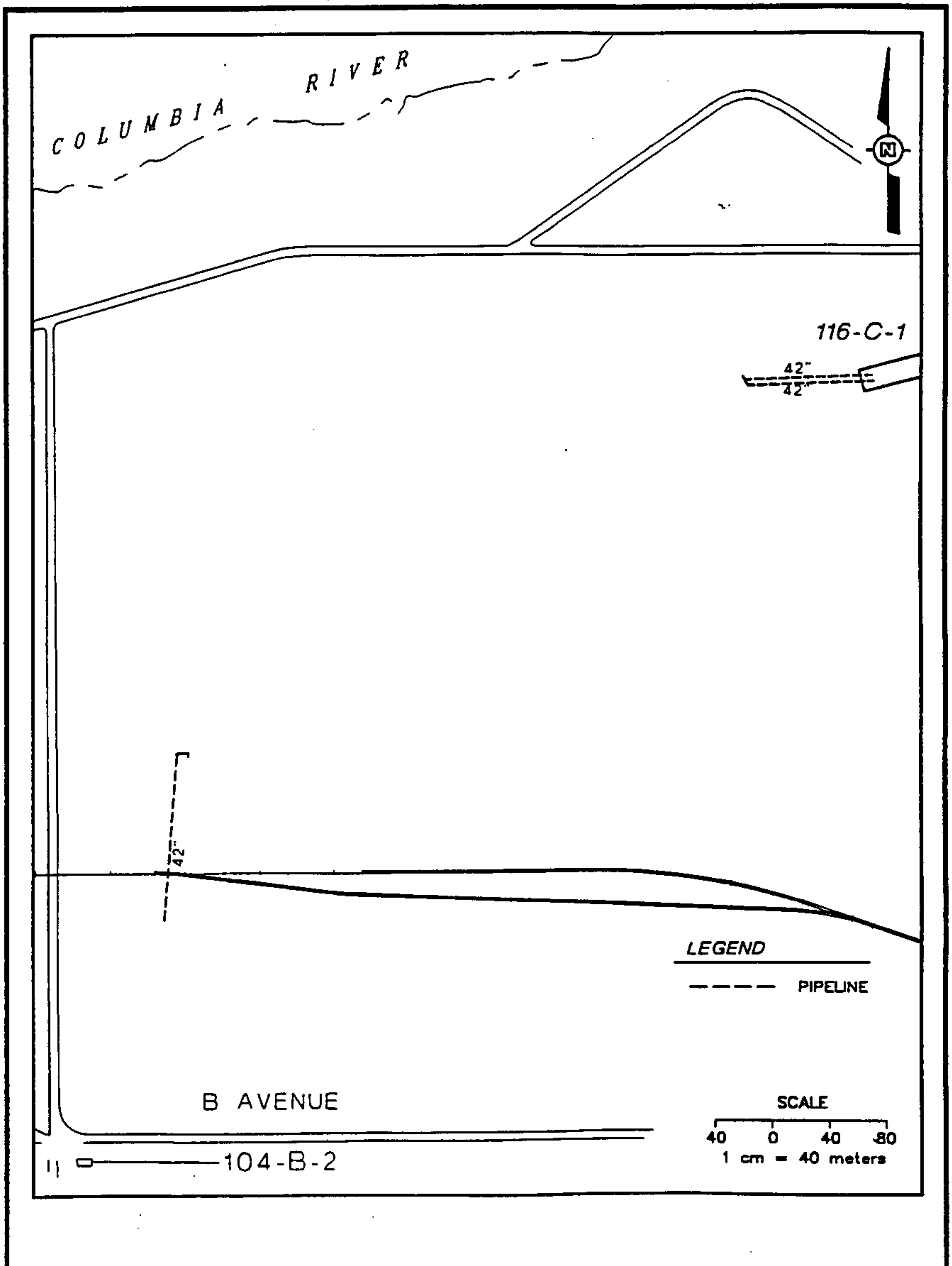
Figure A-15 100 B/C 24 inch Pipelines



PLN24

Figure 16. 100 B/C 42 inch Pipelines.

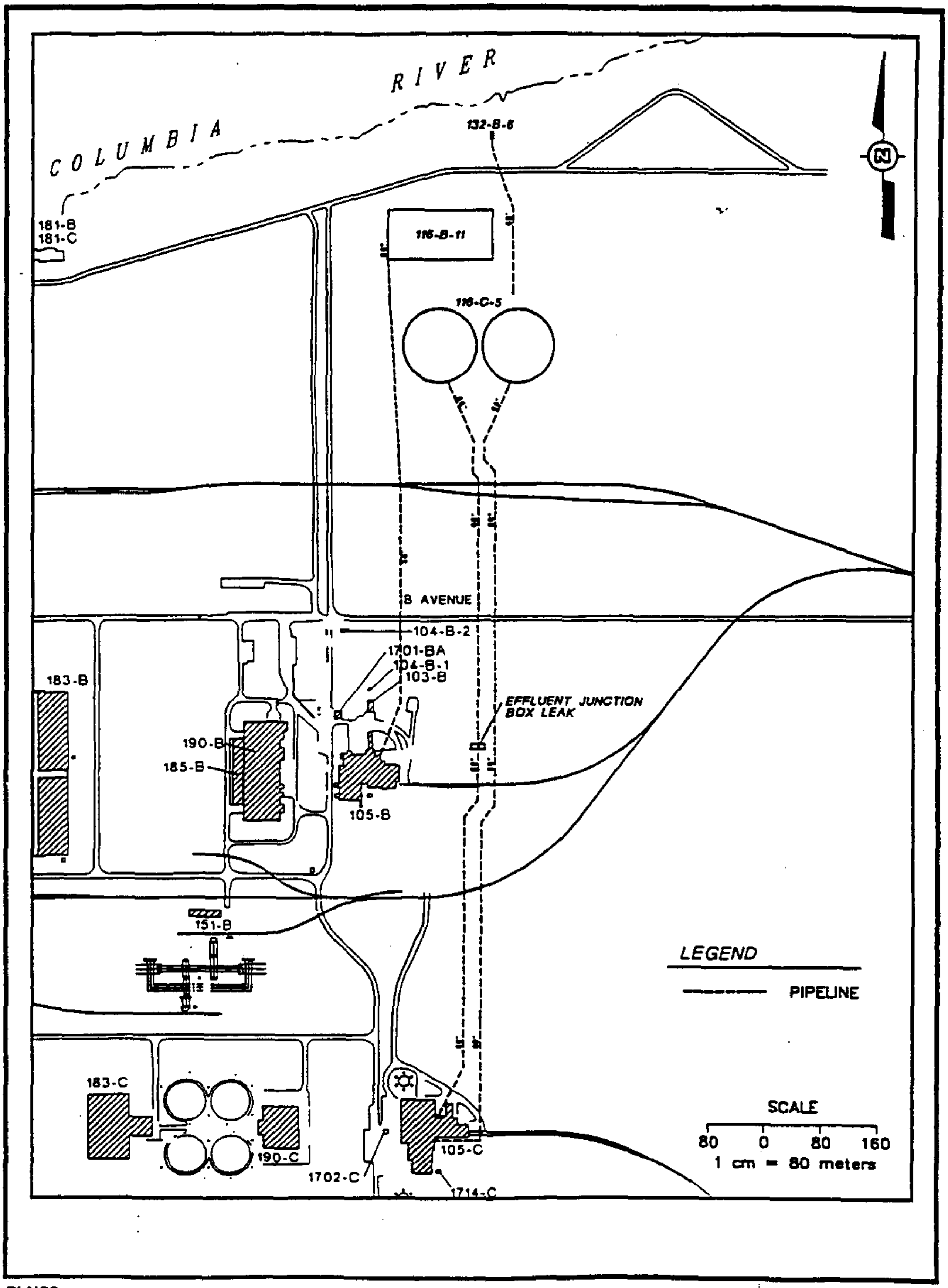
Figure A-16 100 B/C 42 inch Pipelines



PLN42

Figure 22. 100 B/C 66 inch Pipelines.

Figure A-22 100 B/C 66 inch Pipelines



ATTACHMENT 2

100-BC-1 OPERABLE UNIT WASTE SITE COST ESTIMATES

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APPENDIX G

100-DR-1 OPERABLE UNIT FOCUSED FEASIBILITY STUDY REPORT

ACRONYMS

ARAR	applicable or relevant and appropriate requirements
ARCL	Allowable residual contamination level
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPC	contaminants of potential concern
D&D	decontamination and decommissioning
EPA	U.S. Environmental Protection Agency
FFS	focused feasibility study
FS	feasibility study
HPPS	Hanford Past-Practice Strategy
ICR	incremental cancer risk
IRM	interim remedial measure
LFI	limited field investigation
O&M	operation and maintenance
PRG	preliminary remediation goals
QRA	qualitative risk assessment
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act*
RI	Remedial Investigation

CONTENTS

CONTENTS

CONTENTS (continued)

FIGURES

TABLES

CONTENTS (continued)

TABLES (continued)

CONTENTS (continued)

TABLES (continued)

1.0 INTRODUCTION

The object of this operable unit-specific FFS is to provide decision makers with sufficient information to allow appropriate and timely selection of interim remedial measures for sites associated with the 100-DR-1 Operable Unit. As discussed in the main text, certain inherent assumptions are required to establish "appropriate and timely" interim remedial measures. The assumptions and qualifiers outlined in the main text have been followed in the work being performed in this appendix. The plug-in approach can be used because this appendix is based on the same land use and groundwater use scenario as used in the Process Document. The sensitivity analysis is then used as a basis to discuss changes to the detailed investigation due to other land use and/or groundwater use scenarios. The interim remedial measure (IRM) candidate waste sites are determined in the limited field investigation (DOE-RL 1993b). Site profiles are developed for each of these waste sites. The site profiles are used in the application of the plug-in approach. The waste site either plugs into the analysis of the alternatives for the group, or deviations from the developed group alternatives are described and documented. A summary of the FFS results for the 100-DR-1 IRM candidate waste sites is as follows:

- None of the waste sites require additional alternative development.
- All of the waste sites directly plug into the waste site group alternatives, except for the effluent pipelines. The site-specific detailed analysis is conducted, referencing the waste site group analysis as appropriate.
- A comparative analysis of remedial alternatives is presented for each waste site.

1.1 PURPOSE AND SCOPE

Low priority sites and potentially impacted river sediment near the 100 Area are not being considered as candidates for IRMs at this time. These and other sites not currently addressed in this document (e.g., process sewer effluent pipelines, 100-D ponds) will be addressed in the future remedial investigation/feasibility documentation under the Hanford Past Practice Strategy (DOE-RL 1991).

This report presents the folllowing:

- 100-DR-1 Operable Unit individual waste site information (Section 2.0)
- Development of individual waste site profiles (Section 2.0)

- Identification of representative groups for individual waste sites and a comparison against the applicability criteria and identification of appropriate enhancements for the alternatives (Section 3.0)

- Discussion of the deviations and/or enhancements of an alternative and additional alternative development, as needed (Section 4.0).

- Detailed analyses for sites that deviate from the representative group alternatives (Section 5.0)

- A comparative analysis for all individual waste sites using the Process Document baseline scenario (Section 6.0)

- A discussion of the modifications and associated comparative analysis to the baseline scenario due to the results of the sensitivity analysis (Section 7.0)

1.2 INCORPORATION OF NATIONAL ENVIRONMENTAL POLICY ACT VALUES

In accordance with DOE Order 5400.4 and Chapter 10 of the *Code of Federal Regulations* (CFR) Part 1021, the considerations (values) of the *National Environmental Policy Act of 1969* (NEPA) are to be incorporated in the CERCLA process. The NEPA considerations are incorporated in the Process Document (Section 3.3).

The NEPA values, such as description of the affected environment (including meteorology, hydrology, geology, ecological resources, and land use), applicable laws and guidelines, short-term and long-term impacts on human health and the environment, and cost are included to a limited degree within a typical CERCLA feasibility study. Other NEPA values not normally addressed in a CERCLA feasibility study, such as socio-economic impacts, cultural resources, and transportation impacts, have been evaluated in the Process Document.

The NEPA impacts that are specific to the 100-DR-1 Operable Unit are discussed in Section 2.2 and detailed analysis of alternatives, as applicable, are addressed in Section 5.0 of this document.

2.0 WASTE SITE INFORMATION

2.1 OPERABLE UNIT BACKGROUND

The 100-DR-1 Operable Unit is located adjacent to the Columbia River shoreline. The 100-DR-1 Operable Unit encompasses approximately 1.5 km^2 (0.59 mi^2). It lies predominantly within the southeast quadrant of Section 15 and the southwest quadrant of Section 14 of Township 14N, Range 26E, and is located within latitude 46°41'30" and 46°42'30" and longitude 119°31'45" and 119°33'00" (Figure 2-1).

The 100-DR-1 Operable Unit is one of three operable units associated with the 100 D/DR Area at the Hanford Site. Two of the 100 D/DR Area operable units are source units and one is a groundwater unit. The 100-DR-1 Operable Unit includes the D Reactor and its associated facilities. It also includes the liquid and sludge disposal sites and solid waste burial grounds associated with operation of the D Reactor. The 100-DR-2 Operable Unit includes the DR Reactor and its associated facilities, liquid disposal sites, solid waste burial grounds, decommissioned ponds, burn pits, and septic tank systems. The 100-HR-3 Groundwater Operable Unit includes the groundwater below the source operable units as well as the adjacent groundwater, surface water, sediments, and aquatic biota impacted in the vicinity of 100 D/DR Area operations.

Since the preparation of the *100 Area Feasibility Study Phases 1 and 2* (DOE-RL 1993a), additional data has been collected that is relevant to the 100 Area in general and to the 100-DR-1 Operable Unit specifically. A LFI and QRA were performed for the 100-DR-1 Operable Unit. The LFI assumes that burial grounds are IRM candidate sites regardless of the above criteria. The results of the IRM candidacy evaluation are presented in Table 2-1. The sludge trenches were separated into the 107-D sludge trenches and the 107-DR sludge trenches. Due to the lack of site specific data on the sludge trenches, they are combined and designated as 107-D/DR sludge trenches in this site-specific FFS. The 116-D-5 and 116-DR-5 outfall structures are currently scheduled for an ERA and therefore are not addressed further in this site-specific FFS appendix.

The conclusions drawn during the LFI assessment are used only to determine IRM candidacy for high-priority solid waste burial ground sites within the 100-DR-1 Operable Unit. While this site-specific FFS appendix relies on the data presented in the LFI/QRA, assessments, evaluations, and conclusions drawn by this DR-1 appendix are based on the methodology described in the Process Document. In addition, aggregate area studies were performed to evaluate cultural resources and area ecology. A summary of site background and ecological information are presented in Section 3.0 of the Process Document. The cultural resources of 100-DR-1 operable unit are discussed below.

Cultural Resources. The Hanford Cultural Resources Laboratory conducted an archaeological survey during fiscal year 1991 for the 100 Area reactor areas on the Hanford

Site (Chatters et al. 1992). A summary of Hanford Site cultural resources is in Cushing (1992). The following is an excerpt from Cushing (1992) on the 100 D and 100 DR Areas.

> "These are located in a segment of the Columbia River considered to be poor in cultural resources, at least on the basis of reconnaissance-level surveys. Eight known archaeological sites lie within 2 km (1.2 mi) of the areas, two on the opposite bank of the Columbia River and six on the reactor side of the river. Sites 45GR307 and 45GR308 are open campsites of unknown age. Sites 45BN439 and 45BN459 are occupation sites of undetermined age; sites 45BN442, 45BN443, and 45BN444 are cairns or graves; and 45BN461 is a fishing site."

The NEPA values discussion in the Process Document encompasses impacts conclusively for the 100 Area Source Operable Units. Other NEPA values, such as ecological socioeconomics, transportation, recreation and aesthetics impacts within the 100-DR-1 Operable Unit, are consistent with the Process Document (Section 3.3) discussion.

2.1.1 Site Descriptions

To aid in the identification of the appropriate waste site group, the original physical and functional characteristics of each IRM candidate site has been developed. These characteristics include site name, functional use, physical description, and data sources.

Site Name - The site name is the initial indicator of the appropriate group.

Functional Use - Functional use of the site is an important characteristic in determination of waste site groupings. For example, if it is known that a site was used for transport of liquid wastes, using Figure 1-4 of the Process Document, it is possible to eliminate many potential groups.

Physical Description - This element defines the physical characteristics of a site by identifying both size and structure. These characteristics are valuable for evaluating extent of contamination, as well as identifying media/material.

Data Source - Identifies source of data for each waste site.

Descriptions of each IRM candidate site are presented in Table 2-2.

2.1.2 Refined Contaminants of Potential Concern

In a manner similar to the method described in Section 2.7 of the Process Document, refined contaminants of potential concern (COPC) have been developed for each IRM candidate site. These refined COPC are developed by screening the COPC from the 100-DR-1 QRA (WHC 1993) against the preliminary remediation goals (PRG) defined in Table A-2 of Appendix A. Tables 2-3 through 2-10 present the evaluation of refined COPC for waste sites with site specific data. Waste sites that do not have site-specific data use data from the group site profile for COPC, and therefore no site specific COPC evaluation table is presented. Burial grounds use process knowledge data from Miller and Wahlen (1987) to determine COPC, and no site-specific evaluation tables are presented.

The PRG are developed under an occasional land use scenario considering risk to human and ecological receptors, compliance with ARAR, protection of groundwater, local background concentrations, and levels of detection. Of the sources of PRG, the most stringent value is used for screening as long as the value is not below local background and is above contractual levels of detection. Another important aspect of the PRG is that the appropriate value varies with depth. As stated in Section 2.2.2 of Appendix A, humans are receptors in the first meter of soil, animals are receptors in the first 2 m (6.0 ft) of soil, plants are receptors in the first 3 m (10 ft) of soil, and protection of groundwater must be considered throughout the soil column.

The data sources used for the identification of refined COPC include:

- LFI for the 100-DR-1 Operable Unit (DOE-RL 1993b)
- *Radiological Characterization of the Retired 100 Areas* (Dorian and Richards 1978)

These data sources are the same as those used to perform the QRA, and constitute the basic data set for the 100 Area source operable units. The study by Dorian and Richards (1978) was comprehensive regarding the number of sites investigated; however, only radiological data were taken, and sampling and analysis protocol was not equivalent to the current standards. The LFI data considered a small number of sites, but collected data for radionuclides, inorganics, and organics. Sampling and analysis protocols for the LFI data are based on standards presented in the associated work plan (DOE-RL 1992b).

The following steps were followed for the assemblage of data for the identification of the refined COPC:

- The vadose zone was broken down into ranges consistent with the zones accessible by receptors as presented in Section 2.3.3 of the Process Document. (i.e., 0 to 1 m [0 to 3 ft] for humans, 0 to 3 m [0 to 10 ft] for plants and animals (Zone 1), and surface to bottom of vadose zone for groundwater (Zone 2).
- Maximum concentrations from the LFI and Dorian and Richards (historical data) (1978) for each interval were identified, and the historical data was decayed to 1992 for consistency with the LFI data.
- The highest concentration between the LFI and historical data was recorded for each interval.
- The maximum concentrations were screened against PRG.

- All constituents which exceed PRG are identified and those that exceed a PRG in any of the intervals are considered refined COPC for the waste site.

When reviewing the data used for the identification of refined COPC, the following should be considered:

- The tables report only maximum concentrations; therefore, it should be noted that the entire data sets as well as the appropriate qualifiers and sampling and analysis protocols are discussed in the data source reports mentioned above.

- Data reported at an interval break, such as 4.5 m [15 ft], was reported in the previous range (i.e., 3 to 4.5 m [10 to 15 ft]).

- Data reported that overlaps ranges is recorded in both ranges (i.e., data from 4 to 4.5 m [14.5 to 16 ft] is recorded in the 3 to 4.5 m [10 to 15 ft] and 4.5 to 6 m [15 to 20 ft] ranges).

- Nickel-63 reported in Dorian and Richards (1978) may have been analyzed using a surrogate. The concentrations reported may therefore not be an accurate representation of the actual concentration at the waste site.

- Total uranium reported in Dorian and Richards (1978) has been recorded as uranium-238 because uranium-238 is the major risk contributor of the uranium isotopes in the QRA.

The screening process results in the identification of all refined COPC that must be addressed by any remedial action at the given IRM candidate site. Tables 2-3 through 2-10 present the PRG screening for those sites that have analytical data.

2.1.3 Waste Site Profiles

Based on the data from the 100-DR-1 Operable Unit LFI (DOE-RL 1993b) and the refined COPC discussed in Section 2.4.2, a profile for each IRM candidate site is developed. The site profiles include waste site characteristics, such as extent of contamination, contaminated media/material, maximum concentrations of the refined COPC, and a determination of exceedance of allowable soil concentrations under a reduced infiltration scenario. The profiles perform two functions. First, they contain the information for comparison to the group profiles and alternative criteria defined in the Process Document Section 4.2); second, they aid in development of a data base used for determining costs and durations of remedial activities (i.e., contaminated volume impacts cost of disposal and duration of excavation). The profile parameters are defined below; site-specific profiles are detailed in Table 2-11.

- <u>Extent of Contamination:</u>

  The extent of contamination includes impacted volume, length, width, area, and thickness. The values for these parameters are based on volume estimates performed for each site (presented in Attachment 1 of this appendix). Volume, length, width, and area do not necessarily impact the determination of appropriate remedial alternatives; however, they are important considerations for developing costs and durations of remedial actions. Thickness of the contaminated lens impacts the implementability of in situ actions such as vitrification, which has a limited vertical extent of influence.

- Contaminated Media/Material:

  The contaminated media and material located at the site are determined and described. Structural materials such as steel, concrete, and wooden timbers influence the applicability of remedial alternatives, as well as equipment needed for actions such as removal. Presence of soils and sludges are necessary for implementation of treatment options such as soil washing. Presence of solid waste media impacts material handling considerations and may require remedial alternatives that vary from sites with contaminated soil.

- Refined COPC/Maximum Concentrations:

  The refined COPC for a site are determined as discussed in Section 2.1.2. The associated maximum concentration for each constituent is the highest concentration detected above PRG in any of the IRM candidate site data. Refined COPC may influence the applicability of remedial alternatives. For instance, the presence of radioactive contaminants may allow natural decay to be a consideration in determining appropriate remedial actions, while the presence of organic contaminants may require that enhancements such as thermal desorption be added to a treatment system. The presence of cesium-137 influences the effectiveness of treatment alternatives such as soil washing.

- Reduced Infiltration Concentration:

  The reduced infiltration concentration is a level considered protective of groundwater under a scenario where hydraulic infiltration is limited by the application of a surface barrier. The derivation of this concentration is documented in Appendix A. The maximum concentration detected is compared to the allowable reduced infiltration concentration. Exceedance of the reduced infiltration concentrations indicates that impact to groundwater will not be mitigated by containment alternatives such as a barrier.

The profiles for each IRM candidate site in the 100-DR-1 Operable Unit are presented in Table 2-11.

Figure 2-1. 100-DR-1 Operable Unit Map.

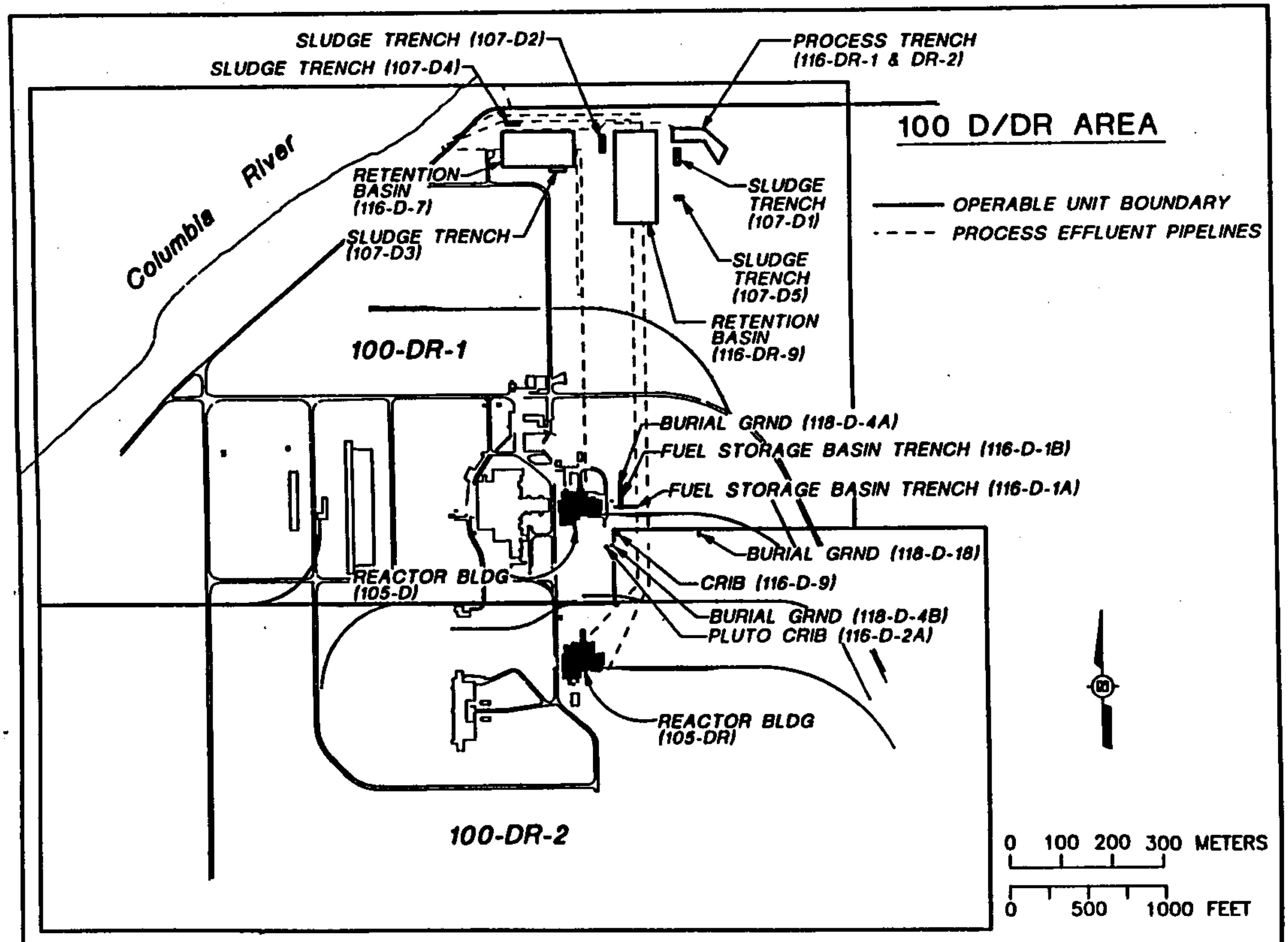

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Figure 2-1 100-DR-1 Operable Unit Map

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Table 2-1. IRM Recommendations from the 100-DR-1 LFI[a].

Waste Site	Qualitative Risk Assessment		Conceptual Model	Exceeds ARAR	Probable Current Impact on Groundwater	Potential for Natural Attenuation by 2018	IRM Candidate yes/no
	Low-frequency scenario	EHQ >1					
116-D-1A	medium	no	adequate	no	yes	yes	yes
116-D-1B	medium	no	adequate	no	yes	yes	yes
116-D-6	low	no	adequate	no	no	yes	no
116-D-7	high	yes	adequate	no	yes	no	yes
116-DR-9	high	yes	adequate	no	yes	no	yes
116-DR-1	medium	no	adequate	no	yes	yes	yes
116-DR-2	medium	no	adequate	no	yes	yes	yes
116-D-2A	low	no	adequate	no	yes	yes	yes
116-D-9	medium	-	adequate	no	yes	yes	yes
132-D-3	low	-	adequate	no	no	yes	yes
116-D-5	medium	no	adequate	no	no	yes	yes
116-DR-5	medium	-	adequate	no	no	yes	yes
116-D-3	very low	no	adequate	no	no	yes	no
116-D-4	very low	no	adequate	no	no	yes	no
130-D-1	low	no	incomplete*	no	no	yes	yes
108-D	low	no	adequate	no	no	yes	no
Sodium Dichromate Tanks	low	no	adequate	no	no	yes	no
103-D	low	-	incomplete*	no	no	yes	yes
126-D-2	medium	-	incomplete*	unknown	no	yes	yes
115-D	low	-	adequate	unknown	no	unknown	yes
117-D	low	-	adequate	unknown	no	unknown	yes
Process Effluent Pipelines	medium	-	adequate	unknown	yes	unknown	yes
107-D Sludge Trenches	high	no	adequate	unknown	yes	no	yes
107-DR Sludge Trenches	high	yes	adequate	unknown	yes	no	yes
118-D-4A, 4B, 18 Burial Grounds							yes

[a]This table is from the 100-DR1 LFI report (DOE/RL 1993b)
- Not rated by the qualitative ecological risk assessment
* Data needed concerning nature and vertical extent of contamination, site remains an IRM candidate until data are available. Therefore, not addressed in this FFS.
ARAR Applicable or relevant and appropriate, specifically the Washington State *Model Toxics Control Act* Method B concentration values for soils
EHQ Environmental Hazard Quotient calculated by the qualitative ecological risk assessment
IRM interim remedial measure

**Table 2-2. 100-DR-1 Site Description.
(page 1 of 2)**

Site#/Name (Alias)	Use	Physical Description	Data Source
116-D-7 (107-D Retention Basin)	Received cooling water effluent from D Reactor and decontamination waste; discharged mostly to the Columbia River; probably received ruptured fuel element waste; much leakage from basin to soil.	Retention basin Reinforced concrete single containment. 142.3 m x 70.1 m x 7.3 m deep	LFI, historical
116-DR-9 (107-DR Retention Basin)	Received cooling water effluent from DR Reactor; probably received ruptured fuel element waste; may have been much leakage to soils from basins.	Retention basin Reinforced concrete single containment. 182.9 m x 83.2 m x 6.1 m deep	LFI, historical
116-DR-1/DR-2 (107-DR Liquid Effluent Disposal Trench #1 and #2)	Received 40 million liters effluent overflow from the 107-D and 107-DR retention basins at times of high activity due to fuel element failure.	Trench Unlined Variable dimensions	LFI, historical
107-D/DR Sludge Disposal Trench #1	Received sludge from D retention basins when they were dredged for repairs.	Trench 38.1 m x 15.2 m x 3.1 m deep	No analytical data
107-D/DR Sludge Disposal Trench #2	Received sludge from D retention basins when they were dredged for repairs.	Trench 38.1 m x 15.2 m x 3.1 m deep	No analytical data
107-D/DR Sludge Disposal Trench #3	Received sludge from D retention basins when they were dredged for repairs.	Trench 38.1 m x 15.2 m x 3.1 m deep	No analytical data
107-D/DR Sludge Disposal Trench #4	Received sludge from D retention basins when they were dredged for repairs.	Trench 32 m x 12.2 m x 3.1 m deep	No analytical data
107-D/DR Sludge Disposal Trench #5	Received sludge from D retention basins when they were dredged for repairs.	Trench 27.4 m x 18.3 m x 3.1 m deep	No analytical data
116-D-1A (105-D Fuel Storage Basin Trench #1)	Received contaminated water from 105-D fuel storage basin (20,000 liters).	Trench Unlined 43.3 m x 6.7 m x 1.8 m deep	LFI, historical
116-D-1B (105-D Fuel Storage Basin Trench #2)	Received contaminated water from 105-D fuel storage basin (eight million liters).	Trench Unlined 39.6 m x 12.2 m x 4.6 m deep	LFI, historical
116-D-2A (105-D Pluto Crib)	Received 4,000 liters effluent water from tubes following fuel cladding failures. In 1956, site was covered to grade with clean soil, sampling did not determine contamination, however, may not have found correct location of crib.	Crib/french drain Gravel filled. 3.1 m x 3.1 m x 3.1 m deep	LFI
116-D-9 Confinement Seal Crib (117-D-Crib)	Received 420,000 liters of waste.	Crib/french drain Gravel filled. 3.1 m x 3.1 m x 3.1 m deep	LFI

Table 2-2 100-DR-1 Site Description (page 2 of 2)

Site#/Name (Alias)	Use	Physical Description	Data Source
Pipelines	Transported reactor cooling water effluent, decontamination wastes, and/or reactor confinement seal pit drainage to retention basins and disposal trenches.	Process effluent pipelines Total length approximately 4,021 m; pipe diameter varies; depth below surface varies.	historical
118-D-4A Burial Ground	Received radioactive and nonradioactive solid waste.	Burial ground 57.9 m x 18.3 m x 6.1 m deep	No analytical data
118-D-4B Burial Ground	Received radioactive and nonradioactive solid waste.	Burial ground 32 m x 7.3 m x 3.7 m deep	No analytical data
118-D-18 Burial Ground	Received radioactive and nonradioactive solid waste.	Burial ground 24.4 m x 12.2 m x 6.1 m deep	No analytical data
132-D-1 (115-D Gas Recirculation Building)	Recirculated cover gases around reactor core.	D&D facility Demolished reinforced concrete. 51.2 m x 29.9 m x 3.4 m tall	D&D (Dement 1986)
132-D-2 (117-D Exhaust Air Filter)	Received reactor building exhaust gas.	D&D facility Demolished reinforced concrete. Building: 18 m x 11.9 m x 8.2 m high Tunnels: 58 m long	D&D (Backstrom and Loveland 1986)
132-D-3 (1608-D Effluent Pumping Facility)	Received water from D Reactor fuel storage basin overflows, also contained decontamination chemicals.	D&D facility 6.1 m x 6.1 m x 9.8 m deep	D&D, LFI (REF)

D&D decontamination and decommissioning
LFI limited field investigation

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Table 2-3. 116-D-7 Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-3. 116-D-7 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

	Zone 1 (a)						Zone 2 (b)												Refined
116-D-7	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO	2.80E-03	NO	2.80E-03	NO		NO		NO		NO	1.20E-02	NO	1.20E-02	NO	3.20E-03	NO	
C-14	**5.89E+01**	YES	**4.29E+02**	YES	4.30E-01	NO		NO		NO		NO		NO		NO		NO	YES
Cs-134	1.33E+00	NO	7.82E+00	NO	1.79E-02	NO	6.58E-02	NO	1.75E-04	NO	2.44E-03	NO	1.70E-03	NO	1.43E-04	NO		NO	
Cs-137	**1.32E+03**	YES	**1.04E+03**	YES	**3.39E+01**	YES	2.08E+01	NO	1.87E+01	NO	3.46E+01	NO	3.11E+01	NO	1.38E+01	NO		NO	YES
Co-60	**3.05E+03**	YES	**8.30E+02**	YES	**6.95E+01**	YES	8.17E+01	NO	2.56E+01	NO	1.46E+02	NO	9.03E+01	NO	1.07E+01	NO		NO	YES
Eu-152	**2.96E+04**	YES	**7.96E+03**	YES	**2.92E+02**	YES	2.78E+02	NO	9.72E+01	NO	2.61E+02	NO	1.24E+02	NO	2.74E+01	NO		NO	YES
Eu-154	**9.94E+03**	YES	**5.68E+03**	YES	**6.53E+01**	YES	7.10E+01	NO	2.30E+01	NO	5.68E+01	NO	2.36E+01	NO	5.40E+00	NO		NO	YES
Eu-155	2.03E+02	NO	6.63E+02	NO	3.10E+00	NO	5.46E+00	NO	4.07E-01	NO	2.89E+00	NO	7.17E-01	NO	9.95E-02	NO		NO	
H-3	1.74E+01	NO	**1.98E+04**	YES	6.08E+00	NO	7.29E+00	NO	2.19E+00	NO	1.01E+01	NO	6.08E+00	NO	1.90E+00	NO		NO	YES
K-40		NO	8.71E+00	NO	8.71E+00	NO		NO		NO		NO	1.25E+01	NO	1.58E+01	NO	1.58E+01	NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63	1.97E+04	NO	1.43E+04	NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238	4.14E+00	NO	4.14E+00	NO		NO	3.52E-03	NO		NO	2.20E-03	NO		NO	4.23E-01	NO		NO	
Pu-239/240	**2.10E+02**	YES	**2.90E+02**	YES	8.30E-01	NO	1.20E+00	NO	3.50E-01	NO	2.30E+00	NO	7.70E-01	NO	1.30E+01	YES	5.60E-03	NO	YES
Ra-226		NO		NO		NO		NO		NO		NO	5.85E-01	NO	7.49E-01	NO	7.49E-01	NO	
Sr-90	**3.73E+02**	YES	2.24E+01	NO	2.92E+00	NO	1.36E+00	NO	1.63E+00	NO	2.31E+00	NO	1.90E+00	NO	1.09E+00	NO	5.70E-01	NO	YES
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO	5.38E-01	NO	5.38E-01	NO		NO		NO		NO	4.49E-01	NO	5.60E-01	NO	5.60E-01	NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO	4.20E-03	NO	4.20E-03	NO		NO		NO		NO	4.60E-03	NO	4.60E-03	NO	1.50E-02	NO	
U-238 (k)	1.90E+00	NO	3.20E+00	NO	7.40E-01	NO	4.30E-01	NO	2.40E-01	NO	5.70E-01	NO	3.60E-01	NO	1.80E-01	NO	1.80E-01	NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO	**5.16E+01**	YES	**5.16E+01**	YES		NO		NO		NO	**3.49E+01**	YES		NO		NO	YES
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-43, 44, 48, 50, 51
DOE-RL, 1993d, Tables 3-13, 14, 15, 16

Table 2-4. 116-DR-9 Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-4. 116-DR-9 Retention Basin Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)										Refined
116-DR-9	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																	
Am-241		NO	1.00E-02	NO	2.00E-02	NO	1.50E-02	NO	8.60E-03	NO	1.30E-02	NO	5.00E-01	NO	1.30E-03	NO	
C-14	1.80E+02	YES	3.00E-01	NO	5.00E-01	NO	3.00E-01	NO	2.20E-01	NO		NO	6.00E-01	NO	3.40E-01	NO	YES
Cs-134	1.24E+00	NO	5.50E-04	NO	4.00E-02	NO	4.00E-02	NO	1.40E-04	NO		NO	3.00E-02	NO	3.00E-02	NO	
Cs-137	3.25E+03	YES	2.98E+02	YES	9.69E+02	YES	1.94E+01	NO	2.56E+00	NO		NO	3.00E-02	NO	2.36E-01	NO	YES
Co-60	2.07E+03	YES	4.27E+01	YES	6.22E+01	YES	6.83E+00	NO	5.49E-02	NO		NO	3.00E-02	NO	2.00E-02	NO	YES
Eu-152	1.11E+04	YES	1.64E+02	YES	2.61E+02	YES	9.28E+00	NO	4.15E-01	NO		NO	7.51E-02	NO		NO	YES
Eu-154	3.98E+03	YES	3.86E+01	YES	5.96E+01	YES	2.22E+00	NO	5.96E-02	NO		NO	7.35E-02	NO		NO	YES
Eu-155	2.46E+01	NO	1.71E+00	NO	3.21E+00	NO	2.00E-01	NO	2.25E-02	NO		NO	2.46E-02	NO		NO	
H-3	5.67E+00	NO	2.03E+00	NO	3.32E+00	NO	2.31E+00	NO	2.31E+00	NO		NO		NO		NO	
K-40		NO	8.10E+00	NO	8.22E+00	NO	8.71E+00	NO	1.13E+01	NO	1.34E+01	NO	1.47E+01	NO	1.28E+01	NO	
Na-22		NO		NO		NO	1.03E-01	NO		NO		NO		NO		NO	
Ni-63	8.50E+03	NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238	9.69E-01	NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240	6.50E+01	YES	1.00E+00	NO	2.10E+00	NO	2.40E+00	NO	1.30E-04	NO	1.30E-03	NO	5.00E-01	NO	1.90E-03	NO	YES
Ra-226		NO	1.10E+00	YES	8.19E-01	NO	8.02E-01	NO	7.65E-01	NO	8.12E-01	NO	8.13E-01	NO	1.23E+00	YES	YES
Sr-90	1.70E+02	YES	3.80E+00	NO	6.72E+00	NO	2.50E+00	NO	1.10E+00	NO	6.60E-01	NO	1.09E+00	NO	7.70E-01	NO	YES
Tc-99		NO	1.30E+00	NO		NO	6.60E-01	NO		NO		NO	1.00E+00	NO	2.40E-01	NO	
Th-228		NO	3.80E-01	NO	4.76E-01	NO	4.75E-01	NO	5.83E-01	NO	5.62E-01	NO	5.75E-01	NO	6.90E-01	NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO	1.60E-01	NO	1.80E-01	NO		NO		NO		NO		NO	
U-235		NO	4.40E-03	NO	8.00E-03	NO	1.10E-02	NO	2.20E-02	NO	6.70E-03	NO	1.00E-02	NO	5.60E-03	NO	
U-238 (k)	9.00E-01	NO	5.10E-01	NO	6.60E-01	NO	3.40E-01	NO	2.00E-01	NO	1.30E-01	NO	2.00E-01	NO	1.70E-01	NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO	1.24E+01	YES		NO		NO		NO		NO		NO		NO	YES
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium	6.80E-01	NO		NO		NO		NO		NO		NO		NO	1.10E+00	YES	YES
Chromium VI		NO		NO	3.00E+01	YES	7.34E+01	YES		NO		NO		NO		NO	YES
Lead		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)	1.30E-01	NO		NO		NO		NO		NO	2.10E-02	NO		NO		NO	
Benzo(a)pyrene		NO	1.10E-01	NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO	1.40E-01	NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol	5.30E-02	NO		NO		NO		NO		NO		NO	5.60E-01	NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
DOE-RL, 1993d, Tables 3-40

Table 2-5. 116-D-1A Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-5. 116-D-1A Fuel Storage Basin Trench Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)																Refined
116-D-1A	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		40 - 45 ft		45 - 50 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																							
Am-241	1.70E-01	NO		NO	1.20E-01	NO	1.50E-02	NO	1.00E+00	NO	1.10E+00	NO	1.10E+00	NO	1.40E+00	NO		NO	1.30E+00	NO	1.30E+00	NO	
C-14	4.00E-01	NO		NO	4.00E-01	NO		NO	4.50E-01	NO		NO	4.80E-01	NO	1.50E-01	NO		NO	3.60E-01	NO	2.90E-02	NO	
Cs-134	2.25E-04	NO		NO		NO	7.00E-02	NO		NO	1.79E-02	NO	6.40E-03	NO		NO		NO		NO		NO	
Cs-137	2.57E+01	YES	2.28E+01	YES	7.88E-02	NO	4.57E+01	NO	1.48E+02	NO	3.74E+02	NO	3.05E+02	NO	1.90E+02	NO		NO	9.46E+01	NO	9.46E+01	NO	YES
Co-60	1.02E+00	NO	7.93E-01	NO		NO	1.15E+01	NO	1.09E+01	NO	8.91E+00	NO	5.25E+00	NO	1.54E+00	NO		NO	5.57E+00	NO	5.57E+00	NO	
Eu-152	9.17E+00	YES	6.63E+00	YES		NO	1.24E+02	NO	1.12E+02	NO	5.75E+01	NO	7.07E+01	NO	3.81E+01	NO		NO	5.90E+01	NO	5.90E+01	NO	YES
Eu-154	8.69E-01	NO	8.24E-01	NO		NO	1.79E+01	NO	1.00E+01	NO	5.97E+00	NO	6.25E+01	NO	6.17E+00	NO		NO	7.25E+00	NO	7.25E+00	NO	
Eu-155	8.24E-02	NO	2.03E-02	NO		NO	2.00E-01	NO		NO	3.32E+00	NO	2.35E+00	NO		NO		NO		NO		NO	
H-3		NO		NO		NO	3.40E+01	NO		NO	4.46E+01	NO		NO		NO		NO		NO		NO	
K-40	1.04E+01	NO		NO	1.11E+01	NO	1.34E+01	NO	6.40E+00	NO	7.73E+00	NO	8.79E+00	NO	8.27E+00	NO		NO	1.20E+01	NO	1.20E+01	NO	
Na-22	3.38E-01	NO		NO		NO		NO	4.72E+00	NO	2.39E+00	NO	2.39E+00	NO	1.84E+00	NO		NO	2.60E+00	NO	2.60E+00	NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240	4.60E-01	NO	2.70E-01	NO	4.70E-01	NO	4.50E+00	YES	6.80E+00	YES	7.10E+00	YES	7.10E+00	YES	8.30E+00	YES		NO	5.70E+00	YES	5.70E+00	YES	YES
Ra-226		NO		NO	8.03E-01	NO	1.00E+00	YES		NO	4.28E+01	YES	4.28E+01	YES		NO		NO		NO		NO	YES
Sr-90	5.00E+00	NO	2.99E+00	NO	4.20E+00	NO	3.67E+01	NO	1.10E-01	NO	3.94E+00	NO	6.65E+00	NO	1.20E+00	NO		NO	2.20E+00	NO	1.80E+00	NO	
Tc-99		NO		NO		NO	8.00E-02	NO	9.90E-02	NO		NO	2.70E-01	NO	5.10E-01	NO		NO		NO		NO	
Th-228	5.62E-01	NO		NO	6.36E-01	NO	6.30E-01	NO		NO		NO	5.00E-01	NO		NO		NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235	7.10E-03	NO		NO	4.40E-03	NO	5.40E-03	NO	6.70E-03	NO	1.20E-02	NO	1.20E-02	NO	7.30E-03	NO		NO	9.10E-03	NO	8.60E-03	NO	
U-238 (k)	1.10E-01	NO		NO	1.30E-01	NO	1.80E-01	NO	2.80E-01	NO	2.70E-01	NO	4.00E-02	NO	1.10E-01	NO		NO	1.20E-01	NO	1.20E-01	NO	
INORGANICS (mg/kg)																							
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO	1.00E+00	YES		NO		NO	9.50E-01	YES		NO	1.00E+00	YES		NO	YES
Chromium VI		NO		NO		NO	4.16E+01	YES	8.71E+01	YES		NO		NO	1.08E+02	YES		NO	4.21E+01	YES		NO	YES
Lead		NO		NO		NO		NO	3.86E+01	YES	1.94E+01	YES	2.76E+01	YES	5.19E+01	YES		NO	3.60E+01	YES	3.60E+01	YES	YES
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																							
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors
(b) PRGs are established to be protective of groundwater
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 3-4-13
DOE-RL, 1993d, Tables 3-3, 4

Table 2-6. 116-D-1B Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater.

Table 2-6. 116-D-1B Fuel Storage Basin Trench Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-D-1B	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO	1.30E+00	NO	1.30E+00	NO	7.10E-02	NO	7.10E-02	NO		NO		NO	
C-14		NO		NO		NO	2.30E-02	NO	4.40E-01	NO	3.50E-01	NO	5.00E-01	NO	6.00E-01	NO		NO	
Cs-134		NO		NO		NO	1.75E-02	NO		NO		NO	1.95E-01	NO	1.95E-01	NO		NO	
Cs-137	**9.69E+00**	**YES**	**2.49E+01**	**YES**		NO	3.22E+02	NO	3.22E+02	NO	3.88E+01	NO	4.22E+01	NO	5.35E-02	NO		NO	YES
Co-60	2.44E-01	NO	1.12E+00	NO		NO	1.63E+01	NO	1.63E+01	NO	2.32E+00	NO	1.71E+00	NO	3.00E-02	NO		NO	
Eu-152	2.21E+00	NO	9.72E+00	YES		NO	1.47E+02	NO	1.47E+02	NO	6.63E+00	NO	1.19E+01	NO	1.42E+00	NO		NO	YES
Eu-154	3.41E-01	NO	1.11E+00	NO		NO	1.59E+01	NO	9.82E+01	NO	4.23E-01	NO	1.48E+00	NO	1.00E-01	NO		NO	
Eu-155	1.18E-02	NO	5.67E-02	NO		NO	7.38E+01	NO	3.85E-02	NO	2.68E-02	NO	1.00E-01	NO	1.00E-01	NO		NO	
H-3		NO		NO		NO	7.29E+00	NO	6.08E+00	NO		NO		NO	8.51E+00	NO		NO	
K-40		NO		NO		NO	8.99E+00	NO	1.41E+01	NO	8.86E+00	NO	8.86E+00	NO	8.84E+00	NO		NO	
Na-22		NO		NO		NO	5.70E+00	NO	5.70E+00	NO		NO	1.25E-01	NO	1.25E-01	NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO	3.00E-01	NO		NO	**5.30E+00**	**YES**	**5.30E+00**	**YES**	4.60E-01	NO	3.20E-01	NO		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO	5.00E-01	NO	6.00E-01	NO		NO	
Sr-90	1.63E+00	NO	5.36E+00	NO	3.20E+01	NO	3.20E+01	NO	4.07E+01	NO	8.40E+00	NO	8.40E+00	NO	1.97E+01	NO		NO	
Tc-99		NO		NO		NO		NO	4.90E-01	NO		NO	1.20E-01	NO	1.20E-01	NO		NO	
Th-228		NO		NO		NO		NO		NO	8.25E-01	NO	8.25E-01	NO	5.35E-01	NO		NO	
Th-232		NO		NO		NO		NO		NO		NO	6.08E-01	NO	6.08E-01	NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO	6.70E-03	NO	6.70E-03	NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO	2.50E-01	NO	2.50E-01	NO	1.20E-01	NO	1.20E-01	NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO	**3.04E+01**	**YES**	**3.04E+01**	**YES**		NO		NO		NO		NO	YES
Lead		NO		NO		NO	**2.20E+01**	**YES**	**2.20E+01**	**YES**		NO		NO		NO		NO	YES
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO	1.06E+02	NO	1.06E+02	NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO	5.80E-02	NO	5.80E-02	NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.

Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 3.4-13
DOE-RL, 1993d, Tables 3-6, 8, 9
Italicized values are reported as "less than" in the source documents.

Table 2-7. 116-DR-1 Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario.

Table 2-7. 116-DR-1 Process Effluent Trench Refined Contaminants of Potential Concern based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-DR-1	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO	1.50E-01	NO	1.50E-01	NO	3.40E-02	NO	9.40E-03	NO	1.30E-02	NO		NO	
C-14		NO		NO		NO	8.40E-02	NO	8.40E-02	NO	1.70E-01	NO	5.30E-01	NO	1.00E-02	NO		NO	
Cs-134		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO		NO	1.47E+02	NO	1.47E+02	NO	2.88E+01	NO		NO	1.98E-01	NO		NO	
Co-60		NO		NO		NO	2.31E+01	NO	2.31E+01	NO	1.59E+00	NO		NO		NO		NO	
Eu-152		NO		NO		NO	2.58E+02	NO	2.58E+02	NO	1.33E+01	NO	3.36E-01	NO	3.39E-01	NO		NO	
Eu-154		NO		NO		NO	2.57E+01	NO	2.57E+01	NO	1.59E+00	NO		NO		NO		NO	
Eu-155		NO		NO		NO		NO		NO		NO		NO		NO		NO	
H-3		NO		NO		NO		NO		NO		NO		NO		NO		NO	
K-40		NO		NO		NO	2.00E+01	NO	2.00E+01	NO	8.42E+00	NO	1.03E+01	NO	1.02E+01	NO		NO	
Na-22		NO		NO		NO	9.91E+00	NO	9.91E+00	NO	6.10E-01	NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO	8.20E-01	NO	8.20E-01	NO	1.20E-01	NO	1.90E-02	NO	1.10E-01	NO		NO	
Ra-226		NO		NO		NO		NO		NO	6.60E-01	NO	9.24E-01	NO		NO		NO	
Sr-90		NO		NO		NO	1.00E+01	NO	1.00E+01	NO	2.20E+00	NO	1.70E+00	NO	1.60E-01	NO		NO	
Tc-99		NO		NO		NO	9.10E-01	NO	9.10E-01	NO	5.30E-01	NO		NO		NO		NO	
Th-228		NO		NO		NO		NO	5.08E-01	NO	5.08E-01	NO	4.64E-01	NO	4.33E-01	NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO	1.30E-02	NO	1.30E-02	NO	1.30E-02	NO	5.10E-03	NO		NO		NO	
U-238 (k)		NO		NO		NO	2.00E-01	NO	2.00E-01	NO	1.90E-01	NO	1.30E-01	NO	1.20E-01	NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO	**1.86E+02**	**YES**	**1.86E+02**	**YES**		NO		NO		NO		NO	YES
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO	1.09E+02	NO	1.09E+02	NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
DOE-RL, 1993b, Tables 3-2,3
Site specific data for 116-DR-1. See 116-DR-2 for historical data

Table 2-8. 116-DR-2 Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario.

Table 2-8 116-DR-2 Process Effluent Trench Refined Contaminants of Potential Concern based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)												Refined
116-DR-2	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		35 - 40 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																			
Am-241		NO		NO		NO	2.60E-02	NO	2.60E-02	NO	5.50E-03	NO		NO		NO		NO	
C-14		NO		NO		NO	8.30E-01	NO	8.30E-01	NO	6.80E-01	NO	1.20E-01	NO	1.90E-01	NO	6.60E-03	NO	
Cs-134		NO		NO	2.07E-03	NO	1.20E-02	NO	1.43E-03	NO	1.10E-02	NO	7.20E-02	NO		NO		NO	
Cs-137		NO		NO	5.61E+01	YES	2.23E+02	NO	2.33E+02	NO	8.30E+02	YES	3.53E+01	NO		NO		NO	YES
Co-60		NO		NO	1.95E+00	NO	1.34E+01	NO	5.73E+00	NO	3.90E+01	NO	2.44E+00	NO		NO		NO	
Eu-152		NO		NO	4.42E+01	YES	2.03E+02	NO	2.40E+01	NO	2.78E+02	NO	9.72E+00	NO		NO		NO	YES
Eu-154		NO		NO	5.96E+00	NO	2.81E+01	NO	2.53E+00	NO	4.26E+01	NO	2.84E+00	NO		NO		NO	
Eu-155		NO		NO	5.56E-01	NO	3.10E+00	NO	2.14E-02	NO	9.84E-01	NO	2.25E-01	NO		NO		NO	
H-3		NO		NO	1.01E+00	NO	6.08E+00	NO		NO	5.67E+00	NO		NO		NO		NO	
K-40		NO		NO		NO	1.00E+01	NO	1.00E+01	NO	9.09E+00	NO	8.73E+00	NO		NO		NO	
Na-22		NO		NO		NO	9.79E-01	NO	9.79E-01	NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO	5.10E-01	NO	1.40E+01	YES	1.40E+01	YES	3.20E+00	NO		NO		NO		NO	YES
Ra-226		NO		NO		NO		NO		NO		NO	4.07E-01	NO		NO		NO	
Sr-90		NO		NO	3.19E+00	NO	5.09E+00	NO	7.80E-01	NO	9.51E+00	NO	4.55E+00	NO	9.90E-01	NO	1.70E+00	NO	
Tc-99		NO		NO		NO		NO		NO		NO	3.40E-01	NO	1.10E+00	NO		NO	
Th-228		NO		NO		NO		NO		NO		NO	3.67E-01	NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO	4.83E-01	NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO	1.80E-01	NO	1.80E-01	NO	1.70E-01	NO	3.80E-01	NO		NO		NO		NO	
INORGANICS (mg/kg)																			
Antimony		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO	1.10E+00	YES		NO		NO		NO		NO	YES
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																			
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Sources:
Dorian, J.J., and V.R. Richards, 1978, Tables 2.7-47
Historical data is for 116-DR-1 and 116-DR-2 combined.
DOE-RL, 1993d, Tables 3-36, 3-37

Table 2-9. 116-D-2A Refined Contaminants of Potential Concern Based on Occasional Use Scenario.

Table 2-9. 116-D-2A Pluto Crib Refined Contaminants of Potential Concern Based on Occasional Land Use Scenario and Protection of Groundwater

	Zone 1 (a)						Zone 2 (b)										Refined
116-D-2A	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		COPC
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Summary
RADIONUCLIDES (pCi/g)																	
Am-241		NO		NO		NO	1.00E-01	NO	1.50E-02	NO	6.00E-04	NO		NO		NO	
C-14		NO		NO		NO	4.40E-02	NO		NO		NO		NO		NO	
Cs-134		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO		NO	1.05E+02	NO	1.99E+01	NO	1.07E+00	NO		NO		NO	
Co-60		NO		NO		NO	1.62E-01	NO		NO		NO		NO		NO	
Eu-152		NO		NO		NO	6.87E+00	NO	1.26E+00	NO		NO		NO		NO	
Eu-154		NO		NO		NO	5.01E+00	NO		NO		NO		NO		NO	
Eu-155		NO		NO		NO		NO		NO		NO		NO		NO	
H-3		NO		NO		NO		NO		NO		NO		NO		NO	
K-40		NO		NO		NO	1.07E+01	NO	1.34E+01	NO	8.54E+00	NO		NO		NO	
Na-22		NO		NO		NO	2.14E-01	NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO	1.00E+00	NO	1.40E-01	NO	1.40E-02	NO		NO		NO	
Ra-226		NO		NO		NO	**1.30E+01**	**YES**		NO		NO		NO		NO	YES
Sr-90		NO		NO		NO	2.60E+01	NO	3.60E+00	NO	3.30E-01	NO		NO		NO	
Tc-99		NO		NO		NO	5.80E-02	NO	8.00E-02	NO		NO		NO		NO	
Th-228		NO		NO		NO	3.77E-01	NO	6.30E-01	NO	4.23E-01	NO		NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO	8.40E-03	NO	5.40E-03	NO	1.70E-02	NO		NO		NO	
U-238 (k)		NO		NO		NO	1.30E-01	NO	1.80E-01	NO	9.20E-02	NO		NO		NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
DOE-RL, 1993d, Tables 3-40

Table 2-10. 116-D-9 Refined Contaminants of Potential Concern Based on Occasional Use Scenario.

Table 2-10. 116-D-9 Crib Refined Contaminants of Potential Concern based on Occasional Land Use Scenario and Protection of Groundwater

116-D-9	Zone 1 (a)						Zone 2 (b)										Refined COPC Summary
	0 - 3 ft		3 - 6 ft		6 - 10 ft		10 - 15 ft		15 - 20 ft		20 - 25 ft		25 - 30 ft		30 - 35 ft		
	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	Max	Screening*	
RADIONUCLIDES (pCi/g)																	
Am-241		NO		NO		NO		NO	6.10E-03	NO	6.10E-03	NO		NO		NO	
C-14		NO		NO		NO		NO	2.60E-01	NO	2.60E-01	NO	1.50E-01	NO		NO	
Cs-134		NO		NO		NO		NO		NO		NO		NO		NO	
Cs-137		NO		NO		NO		NO		NO		NO		NO		NO	
Co-60		NO		NO		NO		NO		NO		NO		NO		NO	
Eu-152		NO		NO		NO		NO		NO		NO		NO		NO	
Eu-154		NO		NO		NO		NO		NO		NO		NO		NO	
Eu-155		NO		NO		NO		NO		NO		NO		NO		NO	
H-3		NO		NO		NO		NO		NO		NO		NO		NO	
K-40		NO		NO		NO		NO	7.39E+00	NO	7.39E+00	NO	9.35E+00	NO		NO	
Na-22		NO		NO		NO		NO		NO		NO		NO		NO	
Ni-63		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-238		NO		NO		NO		NO		NO		NO		NO		NO	
Pu-239/240		NO		NO		NO		NO		NO		NO		NO		NO	
Ra-226		NO		NO		NO		NO	3.55E-01	NO	3.55E-01	NO	7.26E-01	NO		NO	
Sr-90		NO		NO		NO		NO	2.90E+00	NO	2.90E+00	NO	8.80E-02	NO		NO	
Tc-99		NO		NO		NO		NO		NO		NO		NO		NO	
Th-228		NO		NO		NO		NO	3.52E-01	NO	3.52E-01	NO	4.79E-01	NO		NO	
Th-232		NO		NO		NO		NO		NO		NO		NO		NO	
U-233/234		NO		NO		NO		NO		NO		NO		NO		NO	
U-235		NO		NO		NO		NO		NO		NO		NO		NO	
U-238 (k)		NO		NO		NO		NO	1.80E-01	NO	1.80E-01	NO	3.20E-01	NO		NO	
INORGANICS (mg/kg)																	
Antimony		NO		NO		NO		NO		NO		NO		NO		NO	
Arsenic		NO		NO		NO		NO		NO		NO		NO		NO	
Barium		NO		NO		NO		NO		NO		NO		NO		NO	
Cadmium		NO		NO		NO		NO		NO		NO		NO		NO	
Chromium VI		NO		NO		NO		NO		NO		NO		NO		NO	
Lead		NO		NO		NO		NO		NO		NO		NO		NO	
Manganese		NO		NO		NO		NO		NO		NO		NO		NO	
Mercury		NO		NO		NO		NO		NO		NO		NO		NO	
Zinc		NO		NO		NO		NO		NO		NO		NO		NO	
ORGANICS (mg/kg)																	
Aroclor 1260 (PCB)		NO		NO		NO		NO		NO		NO		NO		NO	
Benzo(a)pyrene		NO		NO		NO		NO		NO		NO		NO		NO	
Chrysene		NO		NO		NO		NO		NO		NO		NO		NO	
Pentachlorophenol		NO		NO		NO		NO		NO		NO		NO		NO	

* Maximum concentrations are screened against the PRG (preliminary remediation goal). "Yes" if the value exceeds the PRG. "No" if the value is below the PRG.
The COPC (contaminants of potential concern) are refined based on the soil concentration and the PRG.
A blank under "Max" means either no information is available or the constituent was not detected.

(a) PRGs are established to be protective of groundwater, human and ecological receptors.
(b) PRGs are established to be protective of groundwater.
Source:
DOE-RL, 1993d, Tables 3-42

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 1 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-D-7 (retention basins)	125760.0	148.4	79.2	11753.0	10.7	Soil Concrete Sludge	Radionuclides	pCi/g	
							^{14}C	$4.3x10^2$	NO
							^{60}Co	$3.05x10^3$	NO
							^{137}Cs	$1.32x10^3$	NO
							^{152}Eu	$2.96x10^4$	NO
							^{154}Eu	$9.94x10^3$	NO
							^{3}H	$1.98x10^4$	NO
							$^{239/240}Pu$	$2.90x10^2$	NO
							^{90}Sr	$3.73x10^2$	NO
							Inorganics	mg/kg	
							Chromium VI	$5.16x10^1$	YES
107 D/DR #1 (sludge trench)	2316.0	38.1	15.2	652.0	4.0	Sludge	Radionuclides	assumed from 116-DR-9 and 116-D-7 data	
							^{14}C		NO
							^{137}Cs		NO
							^{60}Co		NO
							^{152}Eu		NO
							^{154}Eu		NO
							^{3}H		NO
							$^{239/240}Pu$		NO
							^{90}Sr		NO
							^{226}Ra		NO
							^{228}Th		NO
							Inorganics		
							Arsenic		YES
							Cadmium		NO
							Chromium VI		YES

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 2 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
107 D/DR #2 (sludge trench)	2316.0	38.1	15.2	572.0	4.0	Sludge	Radionuclides	assumed from 116-DR-9 and 116-D-7 data	
							^{14}C		NO
							^{137}Cs		NO
							^{60}Co		NO
							^{152}Eu		NO
							^{154}Eu		NO
							^{3}H		NO
							$^{239/240}Pu$		NO
							^{90}Sr		NO
							^{226}Ra		NO
							^{228}Th		NO
							Inorganics		
							Arsenic		YES
							Cadmium		NO
							Chromium VI		YES

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 3 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
107 D/DR #3 (sludge trench)	2316.0	38.1	15.2	579.0	4.0	Sludge	Radionuclides	assumed from	
							^{14}C	116-DR-9 and	NO
							^{137}Cs	116-D-7 data	NO
							^{60}Co		NO
							^{152}Eu		NO
							^{154}Eu		NO
							^{3}H		NO
							$^{239/240}Pu$		NO
							^{90}Sr		NO
							^{226}Ra		NO
							^{228}Th		NO
							Inorganics		
							Arsenic		YES
							Cadmium		NO
							Chromium VI		YES

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 4 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
107 D/DR #4 (sludge trench)	1561.0	32.0	12.2	390.0	4.0	Sludge	Radionuclides	assumed from 116-DR-9 and 116-D-7 data	
							^{14}C		NO
							^{137}Cs		NO
							^{60}Co		NO
							^{152}Eu		NO
							^{154}Eu		NO
							^{3}H		NO
							$^{239/240}Pu$		NO
							^{90}Sr		NO
							^{226}Ra		NO
							^{228}Th		NO
							Inorganics		
							Arsenic		YES
							Cadmium		NO
							Chromium VI		YES

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 5 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
107 D/DR #5 (sludge trench)	2005.0	27.4	18.3	501.0	4.0	Sludge	Radionuclides	assumed from 116-DR-9 and 116-D-7 data	
							^{14}C		NO
							^{137}Cs		NO
							^{60}Co		NO
							^{152}Eu		NO
							^{154}Eu		NO
							^{3}H		NO
							$^{239/240}Pu$		NO
							^{90}Sr		NO
							^{226}Ra		NO
							^{228}Th		NO
							Inorganics		
							Arsenic		YES
							Cadmium		NO
							Chromium VI		YES

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 6 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-DR-9 (retention basin)	260414.0	210.3	101.5	21345.0	12.2	Soil Concrete Sludge	Radionuclides	pCi/g	
							^{14}C	$1.8x10^2$	NO
							^{60}Co	$2.07x10^3$	NO
							^{137}Cs	$3.25x10^3$	NO
							^{152}Eu	$1.11x10^4$	NO
							^{154}Eu	$3.98x10^3$	NO
							$^{239/240}Pu$	$6.50x10^1$	NO
							^{226}Ra	1.25	NO
							^{90}Sr	$1.70x10^2$	NO
							^{228}Th	1.02	NO
							Inorganics	mg/kg	
							Arsenic	$1.24x10^1$	YES
							Cadmium	1.20	NO
							Chromium VI	$7.34x10^1$	YES
116-D-1A (fuel storage basin trench)	4409.0	43.3	6.7	290.0	15.2	Soil	Radionuclides	pCi/g	
							^{137}Cs	$2.57x10^1$	NO
							^{152}Eu	9.17	NO
							$^{239/240}Pu$	8.30	NO
							^{226}Ra	$4.28x10^1$	YES
							Inorganics	mg/kg	
							Cadmium	1.00	NO
							Chromium VI	$1.08x10^2$	YES
							Lead	$5.19x10^2$	NO

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 7 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
116-D-1B (fuel storage basin trench)	2947.0	39.6	12.2	483.0	6.1	Soil	Radionuclides ^{137}Cs ^{152}Eu $^{239/240}Pu$ Inorganics Chromium VI Lead	pCi/g 2.49x10^{1} 9.72 5.30 3.04x10^{1} 2.20x10^{1}	 NO NO NO YES NO
116-DR-1/2 (process effluent trench)	24,447.0	varies	varies	4,215	5.8	Soil	Radionuclides ^{137}Cs ^{152}Eu $^{239/240}Pu$ Inorganics Cadmium Chromium VI	pCi/g 8.30x10^{2} 4.42x10^{1} 1.40x10^{1} mg/kg 1.10 1.86x10^{2}	 NO NO NO NO YES
116-D-2A (pluto crib)	14.4	3.1	3.1	9.6	1.5	Soil Timbers	Radionuclides ^{226}Ra	pCi/g 1.3x10^{1}	 YES
116-D-9 (seal pit crib)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 8 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
100 D/DR (pipelines)	(b)	(b)	(b)	(b)	(b)	Steel Concrete	Radionuclides ^{137}Cs ^{152}Eu ^{154}Eu ^{155}Eu ^{63}Ni ^{238}Pu $^{239/240}Pu$ ^{90}Sr	pCi/g assumed from pipeline group data	NO(c)

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 9 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-D-4A (burial ground)	4564.0	57.9	18.3	1059.0	6.1	Misc. Solid Waste	Radionuclides ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{3}H ^{63}Ni ^{90}Sr Inorganics Cadmium Lead Mercury Organics -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(d)	NO(e)

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 10 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-D-4B (burial ground)	350.0	32.0	7.3	215.0	3.7	Misc. Solid Waste	<u>Radionuclides</u> ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{3}H ^{63}Ni ^{90}Sr <u>Inorganics</u> Cadmium Lead Mercury <u>Organics</u> -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(d)	NO(e)

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 11 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
118-D-18 (burial ground)	625.0	24.4	12.2	237.0	6.1	Misc. Solid Waste	Radionuclides ^{14}C ^{137}Cs ^{60}Co ^{152}Eu ^{154}Eu ^{3}H ^{63}Ni ^{90}Sr Inorganics Cadmium Lead Mercury Organics -no specific constituents identified, but 5% of volume is assumed to be contaminated by organics	(d)	NO(e)
132-D-1 115-D Gas Recirculation Building (D&D)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA

Table 2-11. 100-DR-1 Waste Site Profiles.
(Page 12 of 12)

Waste Site (group)	Extent of Contamination					Media/ Material	Refined COPC	Maximum Concentration Detected (a)	Are Reduced Infiltration Concentrations Exceeded?
	Volume (m^3)	Length (m)	Width (m)	Area (m^2)	Depth (m)				
132-D-2 117-D Filter Building (D&D)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA
132-D-3 Effluent Pumping Station (D&D)	0.0	0.0	0.0	0.0	0.0	NA	None	NA	NA

(a) Where concentration exceeds preliminary remediation goals.
(b) Based on retention basin group profile
(c) Based on group profile
(d) No quantitative data is available. Constituents are assumed from Miller and Wahlen 1987.
(e) It is assumed that burial grounds contain immobile forms of waste; thus, no contaminants are assumed to exceed the reduced infiltration concentrations.
(f) no soil contamination has been identified associated with the pipelines, therefore no volume calculation is made; extent of contamination is limited to the pipeline itself.
COPC contaminants of potential concern
D&D decontamination and decommissioning
NA not applicable

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3.0 RESULTS OF THE PLUG-IN APPROACH

This section provides the "plug-in" (Section 1.4 of the Process Document) approach as applied to the interim remedial measures candidate sites in the 100-DR-1 Operable Unit. The plug-in approach requires identification of the waste site group to which a waste site belongs and an evaluation of the alternate applicable criteria.

Identification of the group to which the waste site belongs is accomplished by using the site descriptions defined in Section 2.0 and by placing the site into the appropriate group in Figure 1-4 of the Process Document. It may be necessary to refer to the group descriptions defined in Section 3.0 of the Process Document. The appropriate group for each site is identified in Table 3-1.

Table 3-1 presents the evaluation of the alternative applicability criteria for each IRM waste site. The evaluation represents step 6 of the plug-in approach and identifies which alternatives and enhancements apply to each site. Any deviation from alternatives developed for the appropriate group in the Process Document are footnoted. As stated in step 6, sites with deviations will be developed further in subsequent sections; however, the general analysis of alternatives in the Process Document (Section 5.0) will be used for sites without deviations.

The deviations indicated on Table 3-1 are briefly summarized as follows: 100 D pipelines exclude the removal/treatment/disposal alternative because there is assumed to be no contaminated soils associated with the contaminated pipe and sludge.

3.1 EXAMPLE APPLICATION OF THE PLUG-IN APPROACH (116-D-2A)

In order to achieve a further understanding of the plug-in approach, an example of its application has been developed. The example site, 116-D-2A, will be evaluated as dictated by the plug-in approach (Section 1.4 of the Process Document). The waste site profile has been defined in Section 2.0 (completing step 4 of the approach). Steps 5 and 6 of the approach are completed below.

3.1.1 Identification of Appropriate Group

The 116-D-2A pluto crib is assessed against the elements of Figure 1-4 of the Process Document to ensure that the appropriate group is identified.

Table 2-2 does not indicate that the 116-D-2A site received solid waste, but shows that the site received effluent waste from the reactor following fuel cladding failures. This indicates that 116-D-2A is a contaminated soil site used for liquid effluent disposal. Table 2-2 does indicate that 116-D-2A is a 3.1 m x 3.1 m x 3.1 m (10 ft x 10 ft x 10 ft) gravel-filled site. It can be concluded that the appropriate group for 116-D-2A is the pluto crib. The profile for the group and the associated detailed and comparative analyses are documented in the Process Document.

3.1.2 Evaluation of the Alternative Applicability Criteria

Based on the description and profile developed for waste site 116-D-2A in Section 2.0, an evaluation of the alternative applicability criteria can be accomplished. The evaluation of each alternative is presented below.

No Action - Data indicate that there is contamination present at the site which warrants action; therefore, no action is not an acceptable alternative.

Institutional Controls - Refined COPC are identified for waste site 116-D-2A in Table 2-13 indicating that there are contaminants present that exceed PRG. Therefore, institutional controls will not effectively address contaminants at the site.

Containment - Because there are contaminants that exceed reduced infiltration concentrations, containment will not be applicable at the site.

Removal/Disposal - Because contaminants exceed PRG, this alternative may be applicable.

In Situ Treatment - Because contaminants exceed PRG, and the contaminated lens is <5.8 m (19 ft), the in situ treatment option may be applicable.

Removal/Treatment/Disposal - Because contaminants exceed PRG, this alternative may be applicable. Thermal desorption enhancement is not necessary because organic contaminants are not present at the site. For cost purposes, it is assumed that 100% of the contaminated soil at 116-D-2A can be effectively treated by soil washing. This percentage is based on the depth, distribution, and concentration of contaminants at the waste site. This does not affect the application of the alternative but does impact the magnitude of volume reduction realized at the site.

This evaluation resulted in the identification of applicable alternatives. These results are compared to the results of the group analysis presented in Table 5-1 of the Process Document to identify deviations.

	116-D-2A Alternatives	Group Alternatives
Applicable	Removal/Disposal In Situ Treatment Removal/Treatment/Disposal	Removal/Disposal In Situ Treatment Removal/Treatment/Disposal
Not Applicable	No Interim Action Institutional Controls Containment	No Interim Action Institutional Controls Containment

The alternatives for waste site 116-D-2A are the same as those for the pluto crib group; therefore, no deviations are identified and the site completely plugs into the analyses for the group.

Table 3-1 Comparison of Waste Sites to Remedial Alternatives. (page 1 of 3)

Waste Site / Group		116-D-7 Retention Basin	116-DR-9 Retention Basin	116-DR-1 116-DR-2 Process Effluent Trench	107-D/DR SLUDGE TRENCHES Sludge Trench
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**			
No Action					
SS-1 SW-1	Criterion: • Has site been effectively addressed in the past?	No	No	No	No
Institutional Controls					
SS-2 SW-2	Criterion: • Contaminants < PRG	No	No	No	No
Containment					
SS-3 SW-3	Criteria: • Contaminants > PRG	Yes	Yes	Yes	Yes
	• Contaminants < reduced infiltration rate concentrations	No	No	No	No
Removal/Disposal					
SS-4 SW-4	Criterion: • Contaminants > PRG	Yes	Yes	Yes	Yes
In Situ Treatment					
SS-8A	Criteria: • Contaminants > PRG	Yes	Yes	Yes	Yes
	• Contamination < 5.8 m in depth	No	No	Yes	Yes
SS-8B	Criteria: • Contaminants > PRG	NA	NA	NA	NA
	• Contaminants < reduced infiltration rate concentrations	NA	NA	NA	NA
SW-7	Criteria: • Contaminants > PRG	NA	NA	NA	NA
	• Contaminants < reduced infiltration rate concentrations	NA	NA	NA	NA
Removal/Treatment/Disposal					
SS-10	Criterion: • Contaminants > PRG	Yes	Yes	Yes	Yes
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system)	No	No	No	No
	• Percentage of contaminated volume less than twice the PRG for cesium-137.	67%	67%	100%	67%
SW-9	Criterion: • Contaminants > PRG	NA	NA	NA	NA
	Enhancement: • Organic contaminants	NA	NA	NA	NA

Table 3-1. Comparison of Waste Sites to Remedial Alternatives. (page 2 of 3)

Waste Site Group		116-D-1A Fuel Storage Basin Trench	116-D-1B Fuel Storage Basin Trench	116-D-2A Pluto Crib	116-D-9 Seal Pit Crib
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**			
No Action					
SS-1 SW-1	Criterion: • Has site been effectively addressed in the past?	No	No	No	Yes
Institutional Controls					
SS-2 SW-2	Criterion: • Contaminants < PRG	No	No	No	No
Containment					
SS-3 SW-3	Criteria: • Contaminants > PRG	Yes	Yes	Yes	NA
	• Contaminants < reduced infiltration rate concentrations	No	No	No	NA
Removal/Disposal					
SS-4 SW-4	Criterion: • Contaminants > PRG	Yes	Yes	Yes	NA
In Situ Treatment					
SS-8A	Criteria: • Contaminants > PRG	Yes	Yes	Yes	NA
	• Contamination < 5.8 m in depth	No	No	Yes	NA
SS-8B	Criteria: • Contaminants > PRG	NA	NA	NA	NA
	• Contaminants < reduced infiltration rate concentrations	NA	NA	NA	NA
SW-7	Criteria: • Contaminants > PRG	NA	NA	NA	NA
	• Contaminants < reduced infiltration rate concentrations	NA	NA	NA	NA
Removal/Treatment/Disposal					
SS-10	Criterion: • Contaminants > PRG	Yes	Yes	Yes	NA
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system)	No	No	No	NA
	• Percentage of contaminated volume less than twice the PRG for cesium-137.	100%	100%	100%	NA
SW-9	Criterion: • Contaminants > PRG	NA	NA	NA	NA
	Enhancement: • Organic contaminants	NA	NA	NA	NA

Table 3-1. Comparison of Waste Sites to Remedial Alternatives. (page 3 of 3)

Waste Site Group		PIPELINES Pipeline	118-D-4A 118-D-4B 118-D-18 Burial Grounds	132-D-1 132-D-2 132-D-3 D&D Facilities
Alternative	**Applicability Criteria and Enhancements**	**Are Applicability Criteria and Enhancements Met?**		
No Action				
SS-1 SW-2	Criterion: • Has site been effectively addressed in the past?	No	No	Yes
Institutional Controls				
SS-2 SW-2	Criterion: • Contaminants < PRG	No	No	NA
Containment				
SS-3 SW-3	Criteria: • Contaminants > PRG	Yes	Yes	NA
	• Contaminants < reduced infiltration rate concentrations	Yes	Yes	NA
Removal/Disposal				
SS-4 SW-4	Criterion: • Contaminants > PRG	Yes	Yes	NA
In Situ Treatment				
SS-8A	Criteria: • Contaminants > PRG	NA	NA	NA
	• Contamination < 5.8 m in depth	NA	NA	NA
SS-8B	Criteria: • Contaminants > PRG	Yes	NA	NA
	• Contaminants < reduced infiltration rate concentrations	Yes	NA	NA
SW-7	Criteria: • Contaminants > PRG	NA	Yes	NA
	• Contaminants < reduced infiltration rate concentrations	NA	Yes	NA
Removal/Treatment/Disposal				
SS-10	Criterion: • Contaminants > PRG	NA(d)	NA	NA
	Enhancements: • Organic contaminants (if yes, thermal desorption must be included in the treatment system)	NA(d)	NA	NA
	• Percentage of contaminated volume less than twice the PRG for cesium-137.	NA(d)	NA	NA
SW-9	Criterion: • Contaminants > PRG	NA	Yes	NA
	Enhancement: • Organic contaminants	NA	Yes	NA

NA - Not Applicable (d) - deviation from waste site group PRG - Preliminary Remediation Goals

4.0 ALTERNATIVE DEVELOPMENT

This section describes the alternative enhancement and site-specific alternative development for waste sites that do not align with the Process Document group profiles.

Alternatives do not require further development if the site plugs directly into the group's profile (Process Document, Section 1-4, step 6a). The sites that meet this requirement include 116-D7, 116-DR-9, 116-DR-1/2, 107-D/DR sludge trenches, 116-D-A, 116-D-1B, 116-D-2A, 116-D-9, 118-D-4A, 118-D-4B, 118-D-18, 132-D-1, 132-D-2, and 132-D-3.

The sites that do not plug in directly (Process Document, Section 1.4, step 6b) can be divided into two groups. The first group includes sites that require enhancements to an alternative or an inclusion, or dismissal of an alternative as originally proposed. The sites that meet this requirement, and the applicable deviation, are as follows: 100 D/DR pipeline does not meet all of the applicability criteria for the pipeline group alternative identified in the Process Document. No contaminated soils have been identified around the pipelines, therefore the removal/treatment/disposal alternative no longer applies. Accordingly, this site deviates from the group due to changes in the applicable alternatives.

The second group of sites that do not plug in are those sites that require a significant modification to an alternative, such as changes in the excavation process or disposal options. Alternatives for sites included in this second group will require additional development. None of the sites within the 100-DR-1 Operable Unit fit into this second set, therefore, additional alternative development is not required.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analysis of the alternatives applicable to the individual waste sites within the 100-DR-1 Operable Unit. In the detailed analysis, each alternative is assessed against the evaluation criteria described in Section 5.1 of the Process Document. The purpose of the detailed analysis is to provide a basis for the comparison of the alternatives and to support a subsequent evaluation of the alternatives made by the decision makers in the remedy selection process.

The detailed analysis for the sites within the 100-DR-1 Operable Unit are presented in the following manner:

- The detailed analyses for those individual waste sites which do not deviate from the waste site groups are referenced to the group discussion presented in the Process Document.
- The detailed analyses for those individual waste sites that deviate from the waste site groups are discussed in Section 5.2.

5.1 SITE-SPECIFIC DETAILED ANALYSIS

Based on the comparison presented in Table 3-1, several of the individual waste sites within the 100-DR-1 Operable Unit plug into the waste site group alternatives; therefore, the detailed analysis for these individual waste sites can be referenced to the Process Document. These individual waste sites include 116-D-7, 116-DR-9, 116-DR-1/2, 107-D/DR sludge trenches, 116-D-1A, 116-D-1B, 116-D-2A, 116-D-9, 118-D-4A, 118-D-4B, 118-D-18, 132-D-1, 132-D-2, and 132-D-3.

The detailed analysis for the remaining waste site (100 D/DR pipelines) is discussed in the following sections. Table 5-1 summarizes the alternatives applicable to each waste site and whether the detailed analysis is covered in the Process Document or discussed below in Section 5.1.1. Tables 5-2 and 5-3 present the remediation costs and durations associated with all waste sites.

5.1.1 100 D/DR Pipeline

This section evaluates the 100 D/DR pipeline site against the CERCLA evaluation criteria. The removal/treatment/disposal alternative (SS-10) is applicable to sites that have contaminated soil. Current documentation indicates that the soil surrounding the 100 D/DR pipeline is not contaminated. Therefore, the soil surrounding the pipelines will not require remedial action. Because the deviation for this site is just an omission of an alternative, no evaluation is required.

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Table 5-1. Waste Site Remedial Alternatives and Technologies

Alternatives		Technologies Included	Waste Site Group										
			116-D-7	116-DR-9	116-DR-1 116-DR-2	107-D/DR Sludge Trenches	116-D-1A	116-D-18	116-D-2A	116-D-9	Pipelines	118-D-4A 118-D-4B 118-D-18	132-D-1 132-D-2 132-D-3
No Action	SS-1 SW-1	None								P			P
Institutional Controls	SS-2 SW-2	Deed Restrictions											
		Groundwater Monitoring											
Containment	SS-3 SW-3	Surface Water Controls									P	P	
		Modified RCRA Barrier									P	P	
		Deed Restrictions									P	P	
		Groundwater Monitoring									P	P	
Removal, Disposal	SS-4 SW-4	Removal	P	P	P	P	P	P	P		P	P	
		Disposal	P	P	P	P	P	P	P		P	P	
In Situ Treatment	SS-8A	Surface Water Controls			P	P			P				
		In Situ Vitrification			P	P			P				
		Groundwater monitoring			P	P			P				
		Deed restrictions			P	P			P				
	SS-8B	Void Grouting									P		
		Modified RCRA Barrier									P		
		Surface Water Controls									P		
		Deed Restrictions									P		
		Groundwater Monitoring									P		
	SW-7	Dynamic Compaction										P	
		Modified RCRA Barrier										P	
		Surface Water Controls										P	
		Groundwater Monitoring										P	
		Deed Restrictions										P	
Removal, Treatment, Disposal	SS-10	Removal	P	P	P	P	P	P	P				
		Thermal Desorption											
		Soil Washing	P	P	P	P	P	P	P				
		Disposal	P	P	P	P	P	P	P				
	SW-9	Removal									P		
		Thermal Desorption									P		
		Compaction									P		
		ERDF Disposal									P		

P - Indicates the detailed analysis which is provided in the Process Document
blank - Technology does not apply to this Waste Site
RCRA - Resource Conservation and Recovery Act
ERDF - Environmental Restoration Disposal Facility

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Table 5-2. 100-DR-1 Site-Specific Alternative Costs.

Table 5-2 100-DR-1 Site-Specific Alternative Costs

Site	Containment			Removal/Disposal			In Situ Treatment			Removal/Treatment/Disposal		
	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth	Capital	O&M	Present Worth
100-DR-1 OPERABLE UNIT												
116-D-7				$8.15E+07	$0.00E+00	$7.68E+07				$8.23E+07	$1.26E+07	$8.77E+07
107 D/DR SLUDGE TRENCHES #1				$1.69E+06	$0.00E+00	$1.61E+06	$3.53E+06	$2.24E+06	$5.49E+06	$2.08E+06	$2.69E+05	$2.24E+06
#2				$1.75E+06	$0.00E+00	$1.67E+06	$3.61E+06	$2.29E+06	$5.63E+06	$2.13E+06	$2.77E+05	$2.30E+06
#3				$1.72E+06	$0.00E+00	$1.64E+06	$3.58E+06	$2.27E+06	$5.57E+06	$2.11E+06	$2.73E+05	$2.28E+06
#4				$1.27E+06	$0.00E+00	$1.22E+06	$2.63E+06	$1.56E+06	$4.00E+06	$1.66E+06	$1.88E+05	$1.79E+06
#5				$1.31E+06	$0.00E+00	$1.25E+06	$2.85E+06	$1.78E+06	$4.42E+06	$1.72E+06	$2.07E+05	$1.84E+06
116-DR-9				$1.02E+08	$0.00E+00	$9.60E+07				$1.02E+08	$2.45E+07	$1.14E+08
116-D-1A				$4.69E+06	$0.00E+00	$4.47E+06				$4.88E+06	$9.50E+05	$5.57E+06
116-D-1B				$1.95E+06	$0.00E+00	$1.86E+06				$2.29E+06	$4.09E+05	$2.58E+06
116-DR-1/2				$1.39E+07	$0.00E+00	$1.33E+07	$3.10E+07	$2.30E+07	$4.88E+07	$1.37E+07	$3.48E+06	$1.63E+07
116-D-2A				$2.77E+05	$0.00E+00	$2.67E+05	$5.98E+05	$8.96E+04	$6.61E+05	$7.08E+05	$9.24E+03	$6.92E+05
116-D-9	Institutional Controls proposed at site											
100 D/DR PIPELINES	$3.23E+07	$1.48E+07	$3.81E+07	$9.03E+06	$0.00E+00	$8.61E+06	$3.68E+06	$0.00E+00	$3.51E+06			
116-D-4A	$1.22E+06	$5.14E+05	$1.45E+06	$2.50E+06	$0.00E+00	$2.38E+06	$1.43E+06	$5.76E+05	$1.69E+06	$2.51E+06	$1.37E+05	$2.53E+06
116-D-4B	$7.01E+05	$2.90E+05	$8.32E+05	$4.34E+05	$0.00E+00	$4.15E+05	$8.18E+05	$3.22E+05	$9.62E+05	$9.16E+05	$2.31E+04	$9.07E+05
116-D-1B	$7.50E+05	$2.67E+05	$8.66E+05	$5.72E+05	$0.00E+00	$5.47E+05	$8.78E+05	$2.95E+05	$1.00E+06	$1.02E+06	$3.08E+04	$1.02E+06
132-D-1	No interim action proposed at site											
132-D-2	No interim action proposed at site											
132-D-3	No interim action proposed at site											

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Table 5-3. 100-DR-1 Site-Specific Alternative Durations.

Table 5-3 100-DR-1 Site-Specific Alternative Durations

Site	Containment Duration (yrs)	Removal/Disposal Duration (yrs)	In Situ Treatment Duration (yrs)	Removal/Treatment/Disposal Duration (yrs)
100-DR-1 OPERABLE UNIT				
116-D-7		1.2		2.1
107 D/DR SLUDGE TRENCHES #1		0.1	0.4	0.1
#2		0.1	0.4	0.1
#3		0.1	0.4	0.1
#4		0.1	0.3	0.1
#5		0.1	0.3	0.1
116-DR-9		1.4		3.2
116-D-1A		0.2		0.3
116-D-1B		0.1		0.1
116-DR-1/2		0.4	3.1	0.5
116-D-2A		0.1	0.1	0.1
116-D-9	Institutional Controls proposed at site			
100 D/DR PIPELINES	1.6	1.0	0.1	
118-D-4A	0.1	0.1	0.1	0.1
118-D-4B	0.1	0.1	0.1	0.1
118-D-18	0.1	0.1	0.1	0.1
132-D-1	No interim action proposed at site			
132-D-2	No interim action proposed at site			
132-D-3	No interim action proposed at site			

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6.0 COMPARATIVE ANALYSIS

This section presents the comparative analysis of remedial alternatives that involves evaluation of the relative performance of each alternative with respect to the evaluation criteria presented in Section 5.0. The purpose of this comparison is to identify the advantages and disadvantages of each alternative so that key tradeoffs can be identified.

Following the methodology of the Process Document, the comparative analysis of the 100-DR-1 alternatives is presented in quantitative format (Tables 6-1 through 6-7). The tables present the alternatives applicable to each waste site and a comparison of the relative differences between each alternative. The comparison consists of identifying the relative rank of the alternative (relative to other applicable alternatives) along with the cost, and a discussion of its specific advantages and disadvantages.[1]

To determine which alternative ranks highest overall for a waste site, the quantitative comparison tables present which alternatives rank highest in those criteria. Tables 6-1 through 6-7 summarize the comparative analysis of the applicable alternatives for each waste site.

Institutional controls are identified as the only applicable alternative for the 116-D-9 seal pit crib (see Section 5.0 of this document and the Process Document). Because there are no other alternatives to compare against, the site is not included in the comparative analysis. Likewise, the Process Document identifies no action for the decontamination and decommissioning groups. Thus, these sites (132-D-1, 132-D-2, and 132-D-3) are not presented in the following tables.

6.1 QUANTITATIVE COMPARISON OF REMEDIAL ALTERNATIVES

6.1.1 Retention Basins

The comparative analysis for retention basins ranked Removal/Disposal ahead of Removal/Treatment/Disposal Alternative. The long-term evaluation criteria for 116-D-7 and 116-DR-9 retention basins scores higher for Removal/Treatment/Disposal; however, all the other evaluation criteria (reduction in toxicity, short term, implementability, and cost) score higher for the removal/disposal alternative. The comparative analysis results are shown in Tables 6-1 and 6-2.

6.1.2 Process Effluent Trenches

The Removal/Disposal, In Situ Vitrification, and Removal/Treatment/Disposal alternatives were considered for 116-DR-1 and 116-DR-2 process effluent trenches. In the long term evaluation criteria, Removal/Treatment/Disposal scored higher than the other two alternatives. In the reduction in toxicity criteria In Situ Vitrification scored the highest. In

[1] Estimates of duration for each alternative are presented in Section 5.0, Table 5-1.

the rest of the evaluation criteria Removal/Disposal received the highest scores and is the highest ranked alternative. The comparative analysis results are shown in Tables 6-3 and 6-4.

6.1.3 Sludge Trenches

There are five sludge trenches in the 100-DR-1 Operable Unit. These sludge trenches were evaluated for Removal/Disposal, In Situ Vitrification, and Removal/Treatment/Disposal Alternatives. the Removal/Treatment/Disposal scored highest for the long term while In Situ Vitrification was better in reduction in toxicity evaluation criteria. For short term, implementability, cost criteria, and Removal/Disposal scored equal or highest and is the highest ranked alternative. The comparative analysis results are shown in Table 6-5.

6.1.4 Fuel Storage Basin Trenches

The 116-D-D-1A and 116-D-1B fuel storage basin trenches were evaluated for Removal/Disposal and Removal/Treatment/Disposal Alternatives. The Removal/Treatment/Disposal Alternative scored higher in long term and reduction in toxicity criteria. However, for the short term, implementability and cost, the highest ranking was Removal/Disposal and overall scored two points higher than the Removal/Treatment/Disposal Alternative. The comparative analysis results are shown in Tables 6-6 and 6-7.

6.1.5 Pluto Crib

The Removal/Disposal, In Situ Vitrification, and Removal/Treatment/Disposal Alternatives were considered for the 116-D-2A pluto crib. The Removal/Treatment/Disposal scored highest for long term. For the reduction in toxicity In Situ Vitrification was better than the other two. The Removal/Disposal scored higher for short term, implementability and cost criteria and was overall the highest ranked alternative for this pluto crib. The comparative analysis results are shown in Table 6-8.

6.1.6 Buried Pipelines

The Containment, Removal/Disposal, and In Situ Grouting were considered as remedial alternatives for the buried pipelines in 100-DR-1 Operable Unit. For the short-term criteria, the containment scored the highest. For cost, the In Situ Grouting was the best alternative. For the other (long term, reduction in toxicity, and implementability) criteria, the Removal/Disposal scored the highest and is the overall highest ranked remedial alternative for the buried pipelines. The comparative analysis results are shown in Table 6-9.

6.1.7 Burial Grounds

There are three burial grounds in 100-DR-1 Operable Unit, which were evaluated for remediation alternatives. The four alternatives considered in this evaluation were Containment, Removal/Disposal, In Situ Compaction, and Removal/Treatment/Disposal.

6.1.8 118-D-4A Burial Ground

The overall highest ranked alternative for 118-D-4A burial ground was Containment, followed by Removal/Treatment/Disposal, In Situ Vitrification, and Removal/Disposal. For long term and reduction in toxicity, Removal/Treatment/Disposal scored the highest. For short term and cost, the containment was better than the other three. For implementability, Containment and Removal/Disposal were equal and better than the rest of the criteria. The comparative analysis results are shown in Table 6-10.

6.1.9 118-D-4B Burial Ground

The Removal/Treatment/Disposal scored better for long term and reduction in toxicity criteria. For short term, containment was the best alternative. For implementability, Containment and Removal/Disposal were equal and better than others. Removal/Disposal scored the highest for cost criteria and was the overall highest ranked remedial alternative. The comparative analysis results are shown in Table 6-11.

6.1.10 118-D-18 Burial Ground

The overall highest ranked remedial alternative for 118-D-18 burial ground was Removal/Disposal. For long term and reduction in toxicity criteria, the Removal/Treatment/ Disposal scored the highest. For short term, Containment was the best alternative. For implementability, Containment and Removal/Disposal were equal and better than others, while Removal/Disposal scored the highest for cost criteria. The comparative analysis results are shown in Table 6-12.

Table 6-1. Quantitative Comparison of Evaluation Criteria for 116-D-7 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			31.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-2. Quantitative Comparison of Evaluation Criteria for 116-DR-9 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			31.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-3. Quantitative Comparison of Evaluation Criteria for 116-DR-1 Process Effluent Trenches.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	8.00	8.00
Total Rank[b]			29.0			16.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-4. Quantitative Comparison of Evaluation Criteria for 116-DR-2 Process Effluent Trenches.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	2.00	2.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	8.00	8.00
Total Rank[b]			29.0			16.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-5. Quantitative Comparison of Evaluation Criteria for Sludge Trenches (1, 2, 3, 4, 5).

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	3.00	3.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	3.00	3.00	1.00	7.00	7.00
Total Rank[b]			29.0			17.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-6. Quantitative Comparison of Evaluation Criteria for 116-D-1A Fuel Storage Basin Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			29.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-7. Quantitative Comparison of Evaluation Criteria for 116-D-1B Fuel Storage Basin Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-8. Quantitative Comparison of Evaluation Criteria for 116-D-2A Pluto Crib.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	8.00	4.00	0.50	7.00	3.50	0.50	6.00	3.00
Implementability	1.00	8.00	8.00	1.00	4.00	4.00	1.00	6.00	6.00
Cost	1.00	10.00	10.00	1.00	4.00	4.00	1.00	4.00	4.00
Total Rank[b]			30.5			19.0			24.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-9. Quantitative Comparison of Evaluation Criteria for Buried Pipelines.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Containment			Removal/Disposal			In Situ Grouting		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	2.00	2.00	1.00	7.00	7.00	1.00	3.00	3.00
Reduction of Mobility or Volume	0.50	1.00	0.50	0.50	3.00	1.50	0.50	2.00	1.0
Short-Term Effectiveness	0.50	7.00	3.50	0.50	6.00	3.00	0.50	6.00	3.00
Implementability	1.00	3.00	3.00	1.00	7.00	7.00	1.00	2.00	2.00
Cost	1.00	1.00	1.00	1.00	4.00	4.00	1.00	10.00	10.00
Total Rank[b]			10.0			22.5			19.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 6-10. Quantitative Comparison of Evaluation Criteria for 118-D-4A Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	10.00	10.00	1.00	6.00	6.00	1.00	9.00	9.00	1.00	6.00	6.00
Total Rank[b]			23.5			21.0			21.5			21.5

Table 6-11. Quantitative Comparison of Evaluation Criteria for 118-D-4B Burial Ground.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	5.00	5.00	1.00	10.00	10.00	1.00	4.00	4.00	1.00	5.00	5.00
Total Rank[b]			18.5			25.0			16.5			21.5

Table 6-12. Quantitative Comparison of Evaluation Criteria for 118-D-18 Burial Grounds.

CERCLA Evaluation Criteria	Remedial Alternatives											
	Containment			Removal/Disposal			In Situ Compaction			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	3.00	3.00	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	2.00	1.0	0.50	3.00	1.5	0.50	2.00	1.0	0.50	5.00	2.5
Short-Term Effectiveness	0.50	9.00	4.50	0.50	3.00	1.50	0.50	7.00	3.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	5.00	5.00	1.00	4.00	4.00	1.00	3.00	3.00
Cost	1.00	6.00	6.00	1.00	10.00	10.00	1.00	2.00	2.00	1.00	5.00	5.00
Total Rank[b]			19.5			25.0			14.5			20.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

7.0 COMPARATIVE ANALYSIS FOR NEW REMEDIATION CONCEPT

As discussed in the introduction, the detailed analysis and comparative analysis performed in Sections 5.0 and 6.0 above were based on the baseline scenario described in the Process Document. The Sensitivity Analysis and New Remediation Concept (Attachments D and F, respectively) evaluated several different land use scenarios and resulted in a modification to the baseline scenario. This new remediation concept is discussed in detail in Attachment F and establishes regulatory bases for protection of human health, ecological protection, groundwater protection, and surface water protection. An evaluation of the effects of this new remediation concept on the analysis presented in the Process Document was performed in Attachment F. The impacts of this new remediation concept that effect the work performed in this FFS Appendix are as follows:

- In Situ Vitrification (ISV) and Containment are no longer alternatives that can be used for the waste sites evaluated in this FFS because they preclude potential future sue of the areas impacted by the waste site.

- The magnitude of excavation (predominantly depth) has been reduced, thus reducing cost by 32% and 30% for Remove/Dispose and Remove/Treat/Dispose Alternatives, respectively.

- The relative effects on the key discriminators that are used to evaluate and compare the alternatives are similar for both Remove/Dispose and Remove/Treat/Dispose.

7.1 DR-1 FFS IMPACTS

The prior discussions relating to the application of the plug-in approach, alternative development, and detailed analysis of alternatives are all still directly applicable to the new remediation concept. The fundamental changes due to the new remediation concept (ISV and containment eliminated and reduction in extent of excavation) do not adversely affect the process or results of the plug-in approach. No new deviations to the plug-in approach have been identified, and thus, no new alternative development is required. The Remove/Dispose and Remove/Treat/Dispose detailed analysis generated in the Process Document and Section 5.0 of this attachment are changed only minimally from the reduced extent of excavation. The risk, impacts, and adverse effects of the Remove/Dispose and Remove/Treat/Dispose Alternatives on workers, human health, and the environment are similar and do not warrant a change to the detailed evaluation. The comparative analysis, however, requires elimination of the ISV and containment alternatives and require a recalculation of cost scoring. This difference in the reduction in costs is minimal and should not change the scores for these two alternatives.

7.2 NEW REMEDIATION CONCEPT COMPARATIVE ANALYSIS

7.2.1 116-D-7 and 116-DR-9 Retention Basins

The Remove/Dispose and Remove/Treat/Dispose Alternatives are the only alternatives applicable to these retention basins. The scoring and ranking as applied in the Process Document and in this FFS Appendix are still valid, except for costs. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, changes the score of the cost category to 10 and 9, respectively. The reduction in excavation does not change the relative advantages and disadvantages of the alternatives. The comparative analysis tables based on the new remediation concept for 116-D-7 are given in Table 7-1 and for 116-DR-9 are given in Table 7-2.

7.2.2 116-DR-1 and 116-DR-2 Process Effluent Trenches

With the elimination of ISV as an alternative for the 116-DR-1 and 116-DR-2 process effluent trenches, now only the Remove/Dispose and Remove/Treat/Dispose Alternatives are applicable to these waste sites. The scoring and ranking as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, does not change the score of the cost category. The results are provided in Table 7-3 and 7-4.

7.2.3 Sludge Trenches

With the elimination of ISV, the 116-B-13 and 116-B-14 sludge trenches were evaluated only for Remove/Dispose and Remove/Treat/Dispose. The scoring and ranking, as applied the Process Document and Section 6.0 of this FFS, are still valid. The cost reduction factors discussed above resulted in no changes to the score of the cost category. The overall ranking of alternatives is provided in Tables 7-5.

7.2.4 116-D-1A and 116-D-1B Fuel Storage Basin Trenches

With the elimination of the ISV and containment alternatives, the Remove/Dispose and Remove/Treat/Dispose Alternatives are the only alternatives applicable to the 116-B-4 French Drain. The scoring and ranking as applied in the Process Document and in this FFS Appendix are still valid except for costs. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, does not change the score of the cost category. The reduction in excavation does not change the relative advantages and disadvantages of the alternatives. The comparative analysis table, based on the new remediation concept for 116-D-1A are given in Table 7-6 and for 116-D-1B are given in Table 7-7.

7.2.5 116-D-2A Pluto Crib

With the elimination of ISV and containment as an alternative for the 116-D-2A pluto crib, now only the Remove/Dispose and Remove/Treat/Dispose Alternatives are applicable to this waste site. The scoring and ranking as applied in the Process Document and Section 6.0

of this FFS, are still valid except for cost. The cost reduction of 32% and 30% for Remove/Dispose and Remove/Treat/Dispose, respectively, does not change the score of the cost category. The results are provided in Table 7-8.

7.2.6 100-D Buried Pipelines

With the elimination of the ISV and containment alternatives for the 100-D pipelines, Remove/Dispose is the only viable alternatives to be considered.

7.2.7 100-D Burial Grounds

With the elimination of ISV and containment, Remove/Dispose and Remove/Treat/Dispose are the only alternatives to be considered. The scoring and ranking as applied in the Process Document and Section 6.0 of this FFS, are still valid except for cost. The Remove/Dispose Alternative is the highest ranked alternative for the 118-D-4A, 118-D-4B, and 118-D-18 burial grounds. These rankings are given in Tables 7-9, 7-10, and 7-11, respectively.

Table 7-1. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-D-7 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	9.00	9.00
Total Rank[b]			31.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-2. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-DR-9 Retention Basin.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	4.00	2.00	0.50	5.00	2.5
Short-Term Effectiveness	0.50	6.00	3.00	0.50	3.00	1.50
Implementability	1.00	9.00	9.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			31.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-3. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-DR-1 Process Effluent Trenches.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-4. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-DR-2 Process Effluent Trenches.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	3.00	1.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-5. New Remediation Concept Quantitative Comparison of Evaluation Criteria for Sludge Trenches (1, 2, 3, 4, 5).

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-6. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-D-1A Fuel Storage Basin Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	8.00	8.00
Total Rank[b]			29.0			27.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-7. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-D-1B Fuel Storage Basin Trench.

CERCLA Evaluation Criteria	Remedial Alternatives					
	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	7.00	3.50	0.50	5.00	2.50
Implementability	1.00	7.00	7.00	1.00	5.00	5.00
Cost	1.00	10.00	10.00	1.00	7.00	7.00
Total Rank[b]			29.0			26.0

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-8. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 116-D-2A Pluto Crib.

CERCLA Evaluation Criteria	Remedial Alternatives								
	Removal/Disposal			In Situ Vitrification			Removal/Treatment/ Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	4.00	4.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	7.00	3.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	8.00	4.00	0.50	7.00	3.50	0.50	6.00	3.00
Implementability	1.00	8.00	8.00	1.00	4.00	4.00	1.00	6.00	6.00
Cost	1.00	10.00	10.00	1.00	4.00	4.00	1.00	4.00	4.00
Total Rank[b]			30.5			19.0			24.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-9. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-D-4A Burial Ground.

CERCLA Evaluation Criteria	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	3.00	1.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	3.00	3.00
Cost	1.00	10.00	10.00	1.00	9.00	9.00
Total Rank[b]			25.0			24.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-10. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-D-4B Burial Ground.

CERCLA Evaluation Criteria	Removal/Disposal			Removal/Treatment/Disposal		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.50	0.50	5.00	2.5
Short-Term Effectiveness	0.50	3.00	1.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	3.00	3.00
Cost	1.00	10.00	10.00	1.00	4.00	4.00
Total Rank[b]			25.0			19.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

Table 7-11. New Remediation Concept Quantitative Comparison of Evaluation Criteria for 118-D-18 Burial Grounds.

CERCLA Evaluation Criteria	**Removal/Disposal**			**Removal/Treatment/Disposal**		
	Weight	Score	Rank[a]	Weight	Score	Rank[a]
Long-Term Effectiveness	1.00	7.00	7.00	1.00	9.00	9.00
Reduction of Mobility or Volume	0.50	3.00	1.5	0.50	5.00	2.5
Short-Term Effectiveness	0.50	3.00	1.50	0.50	2.00	1.00
Implementability	1.00	5.00	5.00	1.00	3.00	3.00
Cost	1.00	10.00	10.00	1.00	5.00	5.00
Total Rank[b]			25.0			20.5

[a]Rank = weight x score
[b]Total Rank = sum of individual rankings

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ATTACHMENT 1

100-DR-1 OPERABLE UNIT WASTE SITE VOLUME ESTIMATES

Volume Estimate
100-DR-1 Operable Unit

OBJECTIVE:

Provide estimates of:

- The volume of contaminated materials within selected waste sites in the 100-DR-1 Operable Unit.
- The volume of materials which will need to be excavated to remove the contaminated materials.
- The areal extent of contamination.

Estimates are provided for the following waste sites:

Site Number	Site Name	Page
116-D-1A	105-D Storage Basin Trench No. 1	G-81
116-D-1B	105-D Storage Basin Trench No. 2	G-83
116-D-2	105-D Pluto Crib	G-85
116-D-7	107-D Retention Basin	G-87
116-DR-1 & 2	107-DR Liquid Waste Trench No. 1 & 2	G-89
116-D-9	117-D Seal Crib	G-92
116-DR-9	107-DR Retention Basin	G-93
132-D-1	115-D Gas Recirculation Building	G-95
132-D-2	117-D Filter Building	G-96
132-D-3	Effluent Pumping Station	G-97
	107-D/DR Sludge Disposal Trench No. 1	G-98
	107-D/DR Sludge Disposal Trench No. 2	G-100
	107-D/DR Sludge Disposal Trench No. 3	G-102
	107-D/DR Sludge Disposal Trench No. 4	G-104
	107-D/DR Sludge Disposal Trench No. 5	G-106
	118-D4-A Burial Ground	G-108
	118-D4-B Burial Ground	G-110
	118-18 Burial Ground	G-112
Pipelines	107-D & 107-DR Process Pipelines	G-114

Volume Estimate
100-DR-1 Operable Unit

METHOD:

The following steps are used to calculate volumes and areas for each waste site:

- Estimate the dimensions of each waste site.
- Estimate the location of the site.
- Estimate the extent of contamination present at each site.
- Estimate the extent of the excavation necessary to remove the contamination present.
- Calculate the volume of contamination present, the volume of material to be removed, and the areal extent of contamination.

Waste Site Dimensions -
Dimensions of the waste site are derived from all pertinent references. The reference used is noted in brackets [].

Waste Site Location -
Location of the waste site is derived from pertinent references, confirmed by field visit. The specific reference or method used to locate each site is discussed in a separate brief [9]. Coordinates for each waste site are converted to Washington State coordinates [9]. Resulting Washington State coordinates are presented herein.

Contaminated Volume Dimensions -
The extent of contamination present at the waste site is estimated from analytical data that exists for the site. The data used, assumptions made, and method for estimating extent is discussed in a separate brief [10]. Dimensions are summarized herein.

Excavated Volume Dimensions -
The extent of the excavation necessary to remove the contamination is based on a 1.5 H : 1.0 V excavation slope with the extent of contamination at depth serving as the bottom of the excavation.

Volume and Area Calculations -
The above information is used to construct a digital terrain model of each site within the computer program AutoCad. The computer program DCA is then used to calculate volumes and areas for the waste site.

ASSUMPTIONS:

The following assumptions were used to locate and/or provide dimensions for a waste site if no other data exists. See reference 10 for assumptions concerning extent of contamination and reference 9 for assumptions concerning location of the waste site.

Volume Estimate
100-DR-1 Operable Unit

ASSUMPTIONS (continued):

Burial Grounds -
- Burial ground dimensions are 6 m (20 ft) wide at the bottom, 6 m (20 ft) deep, and have 1.0 H : 1.0 V side slopes.
- Five feet of additional cover was provided.
- Burial grounds were completely filled.

Liquid Waste Sites -
- Trenches were built with 1.0 H : 1.0 V side slopes.
- Tops of cribs are 1.9 m (6 ft) below grade.

The following assumptions were used in calculating volumes and areas:
- No site interferences or overlaps are considered, volumes and areas are calculated for each waste site separately.

All depths are below grade unless otherwise noted.

REFERENCES:

1. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1994, *Hanford Site Waste Information Data System* (WIDS), Richland, Washington.

2. 100-D Area Technical Baseline Report.

3. Hanford Site Drawings and Plans.

4. Site topographic maps, Drawings.

5. Historical photographs of the 100-D/DR Area.

6. Dorian, J.J., and V.R. Richards, *Radiological Characterization of the Retired 100 Areas*, UNI-946, May 1978, United Nuclear Industries, Richland, Washington.

7. U.S. Department of Energy, Richland Operations Office (DOE-RL), 1993, *Limited Field Investigations Report for the 100-DR-1 Operable Unit*. DOE/RL-93-29, Draft A, U.S. Department of Energy, Richland, Washington.

8. IT Corporation, 1994, "100-DR-1 Waste Site Locations", IT Corporation Calculation Brief, Project Number 199806.406.

9. IT Corporation, 1994, "100-DR-1 Waste Site Contamination Extent", IT Corporation Calculation Brief, Project Number 199806.406.

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-D-1A
SITE NAME: 105-D Storage Basin Trench No. 1

WASTE SITE DIMENSIONS:

Length - 39.6 m (130 ft) along the bottom, 43.3 m (142 ft) at surface [1]
Width - 3.1 m (10 ft) along the bottom, 6.7 m (22 ft) at surface [1]
Depth - 1.8 m (6 ft) [1]
Slopes - 1.0 H : 1.0 V
Orientation - East-West lengthwise

Site was backfilled to 0.6 m (2 ft) above existing grade [2].

CONTAMINATED VOLUME DIMENSIONS:

Trench was filled to grade with liquids, side slopes and substrate and are contaminated from surface to 56 ft bls [10].

Length - 43.3 m (142 ft) [10]
Width - 6.7 m (22 ft) [10]
Depth - 15.2 m (50 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Base of excavation is 43.3 m (142 ft) long by 6.7 m (22 ft) wide at a depth of 15.2 m (50 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 151,590 [9]
Easting: 573,860 [9]

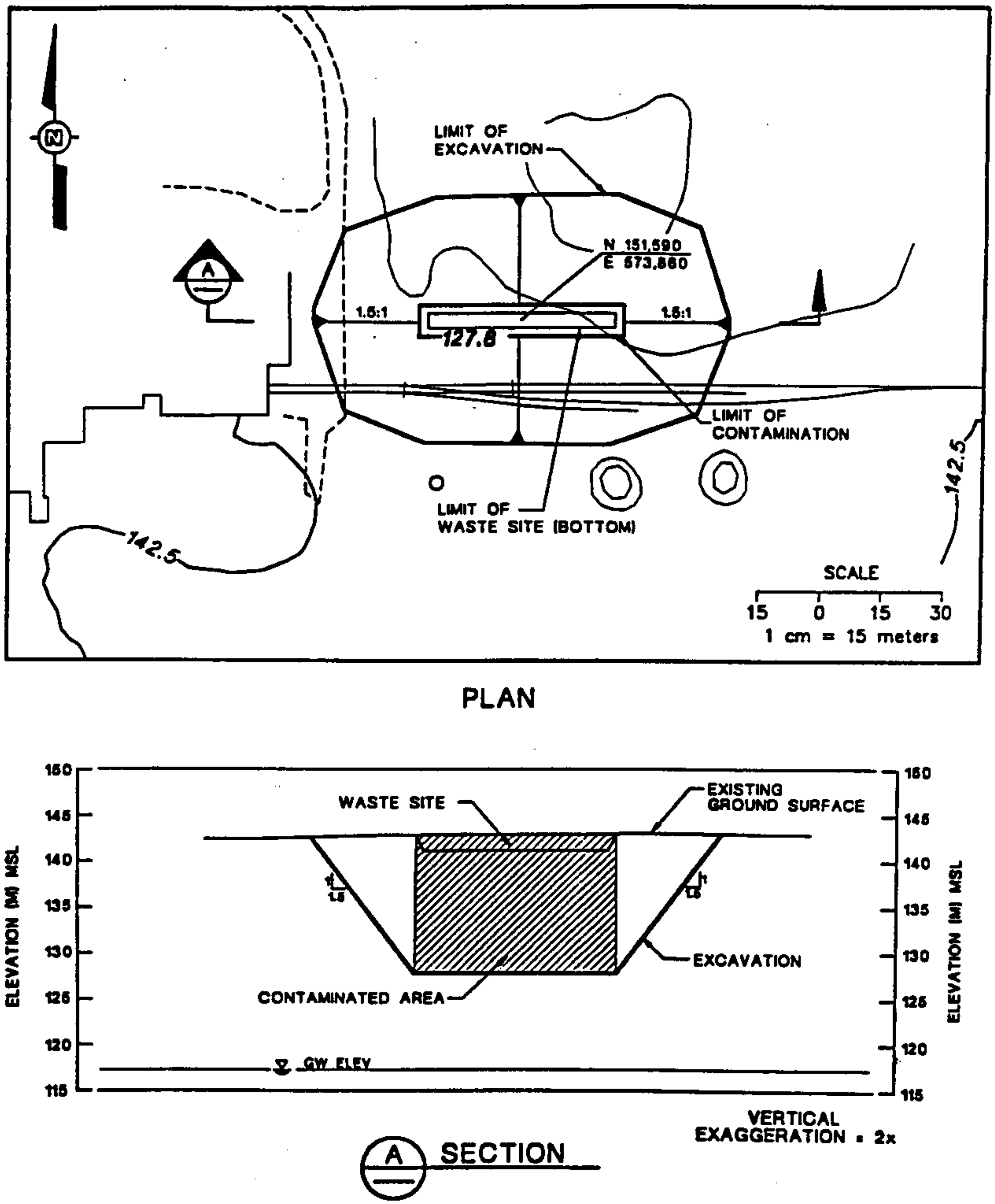
Reference Point: Center of trench [6]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

Figure 1. IRM Site: 116-D-1A.

Figure A-1 IRM Site: 116-D-1A



EXTENT OF CONTAMINATION

SURFACE AREA = 290 sq. meters
VOLUME = 4,409 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 4,012 sq. meters
VOLUME = 28,937 cu. meters

116D1A

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-D-1B
SITE NAME: 105-D Storage Basin Trench No. 2

WASTE SITE DIMENSIONS:

Length - 30.5 m (100 ft) along the bottom, 39.6 m (130 ft) at the surface [1]
Width - 3.1 m (10 ft) along the bottom, 12.2 m (40 ft) at the surface [1]
Depth - 4.6 m (15 ft) [1]
Slopes - 1.0 H : 1.0 V
Orientation - North-South lengthwise

Site was backfilled to 0.6 m (2 ft) above grade [2].

CONTAMINATED VOLUME DIMENSIONS:

Trench was filled to grade with liquids, side slopes, and substrate are contaminated from surface to 6.1 m (20 ft) bls [10].

Length - 39.6 m (130 ft) [10]
Width - 12.2 m (40 ft) [10]
Depth - 6.1 m (20 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Base of excavation is 69.5 m (228 ft) long by 42.1 m (138 ft) wide at a depth of 6.7 m (20 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 151,611 [9]
Easting: 573,848 [9]

Reference Point: Center of west edge of bottom of unit [6].

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

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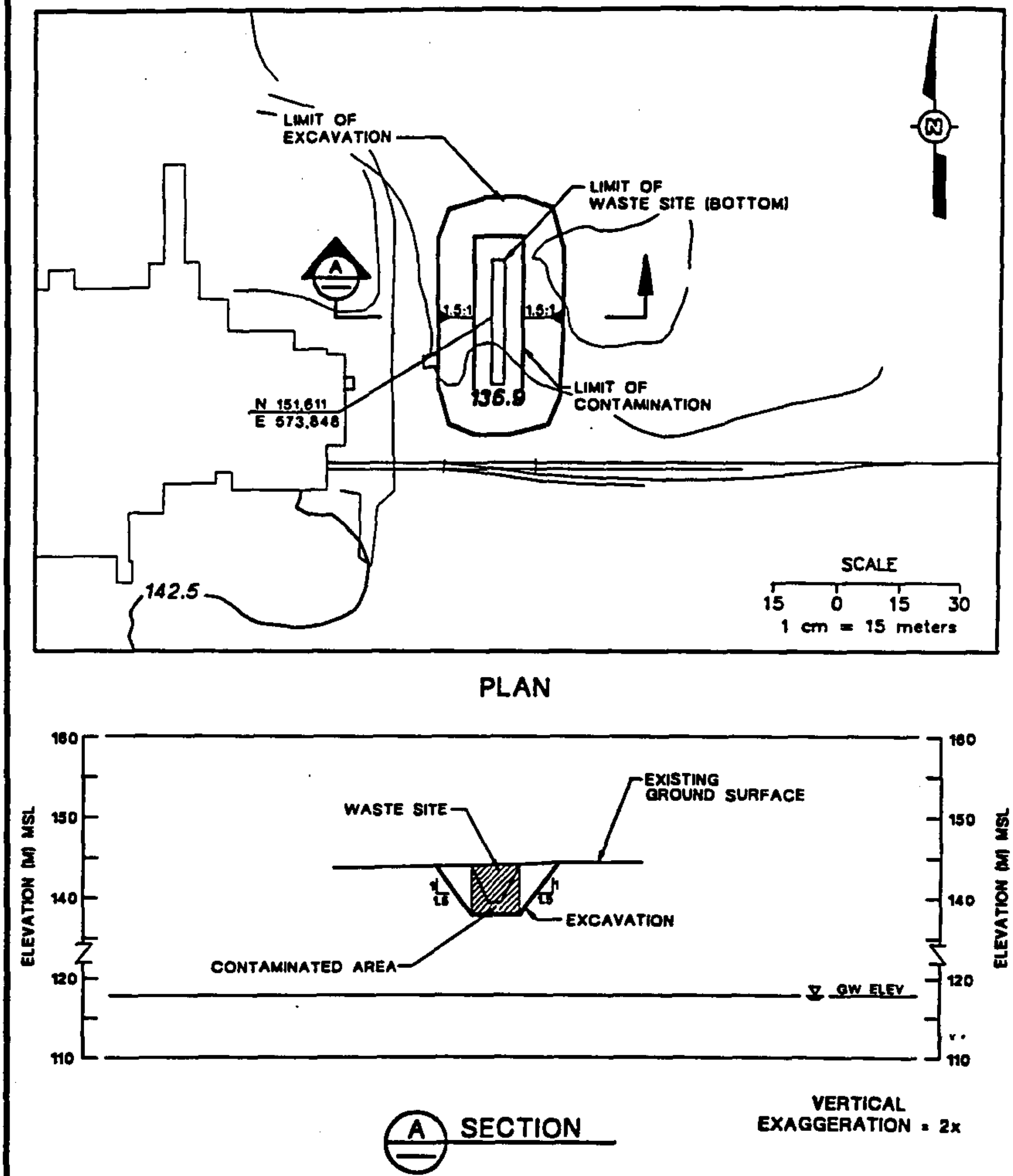
Figure 2. IRM Site: 116-D-1B.

Figure A-2 IRM Site: 116-D-1B



EXTENT OF CONTAMINATION

SURFACE AREA = 483 sq. meters
VOLUME = 2,947 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,703 sq. meters
VOLUME = 6,529 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-D-2
SITE NAME: 105-D Pluto Crib

WASTE SITE DIMENSIONS:

Length - 3.1 m (10 ft) [1,2]
Width - 3.1 m (10 ft) [1,2]
Depth - 3.1 m (10 ft) [1,2]
Slopes - Vertical
Orientation - North-South [5]

The crib was set in ground with its upper surface at grade [2].

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 3.0 m (10 ft) below surface and extends to 4.6 m (15 ft) below surface [10].

Length - 3.1 m (10 ft) [10]
Width - 3.1 m (10 ft) [10]
Depth - 1.5 m (5 ft); from 3.1 m (10 ft) to 4.6m (15 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 3.1 m (10 ft) by 3.1 m (10 ft) at a depth of 4.6 m (15 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 151,510 [9]
Easting: 573,820 [9]

Reference Point: Center of crib [9].

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

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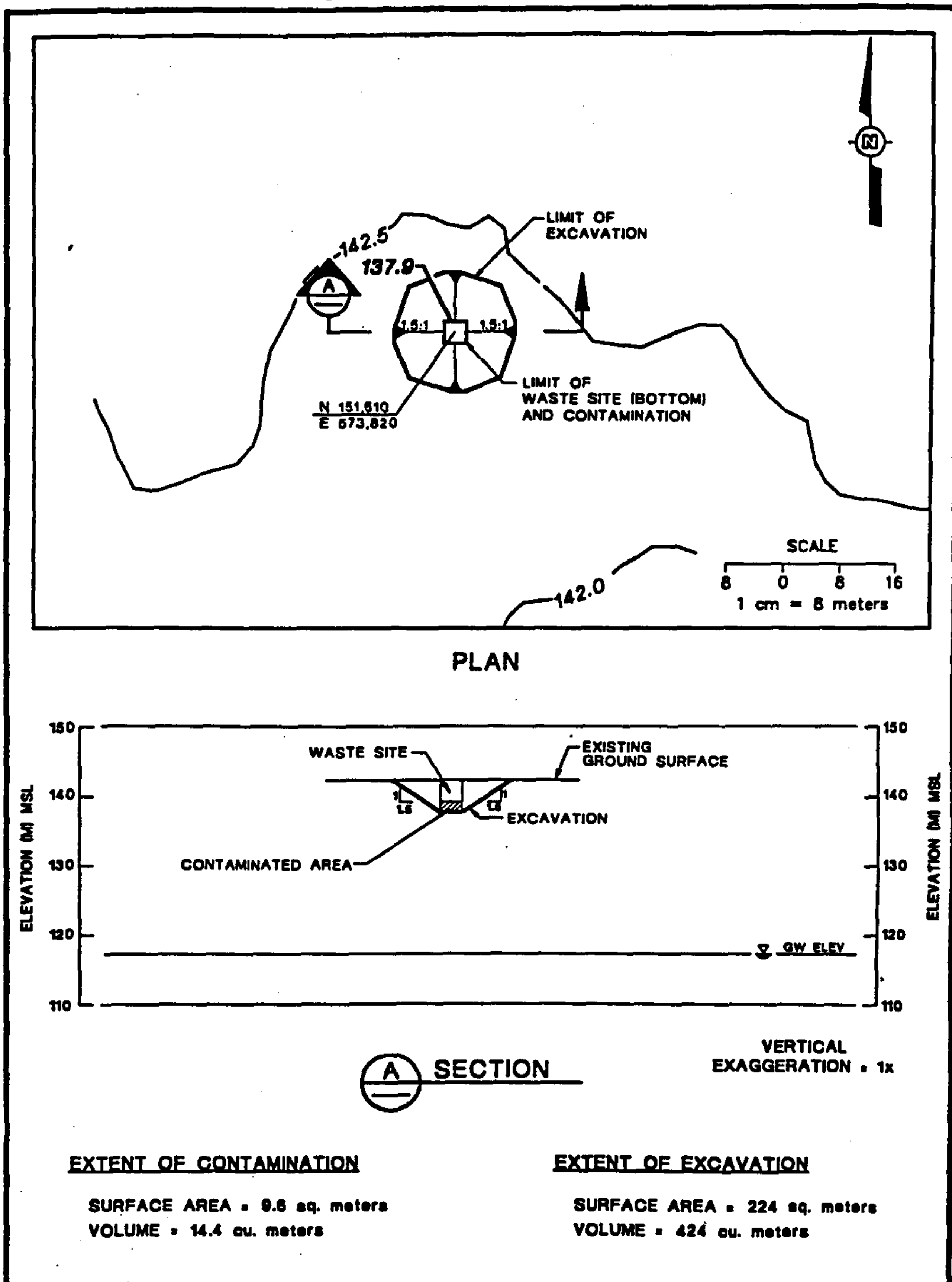
Figure 3. IRM Site 116-D-2.

Figure A-3 IRM Site: 116-D-2



116D2A

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-D-7
SITE NAME: 107-D Retention Basin

WASTE SITE DIMENSIONS:

Length - 142.3 m (467 ft) [1,2,3]
Width - 70.1 m (230 ft) [1,2,3]
Depth - 7.3 m (24 ft) [1,2]
Slopes - Vertical
Orientation - East-West lengthwise [3]

Walls and baffles were demolished, site backfilled with 0.6 m (2 ft) of soil [1].

CONTAMINATED VOLUME DIMENSIONS:

Contamination extends 6.1 m (20 ft) to the north, 3.1 m (10 ft) to the south, east, and west [10].

Length - 148.4 m (487 ft) [10]
Width - 79.2 m (260 ft) [10]
Depth - 10.7 m (35 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 148.4 m (487 ft) by 79.2 m (260 ft) at a depth of 10.7 m (35 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,337 [9]
Easting: 573,624 [9]

Reference Point: Northwest corner [9]

ELEVATIONS:

Surface: 132.5 m (435 ft) [4]
Groundwater: 116.9 m (384 ft) [8]

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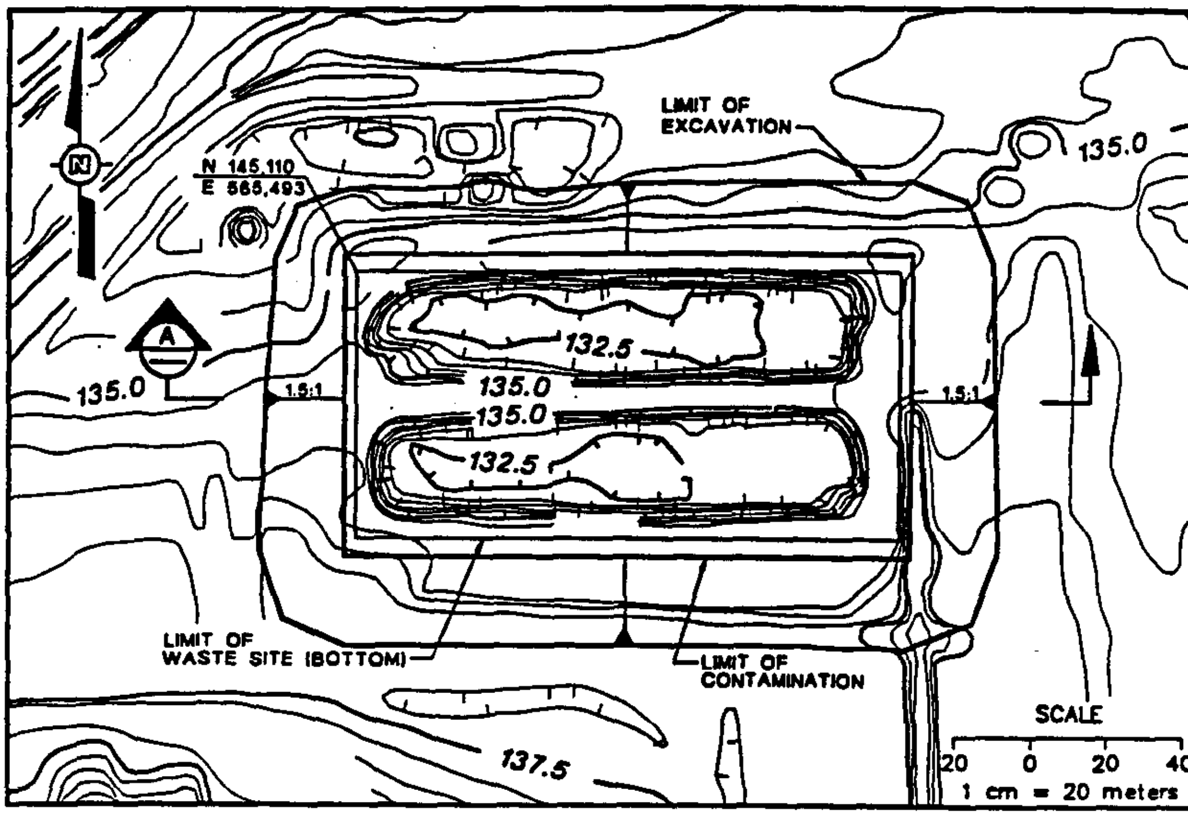
Figure 4. IRM Site: 116-D-7.

Figure A-4 IRM Site: 116-D-7



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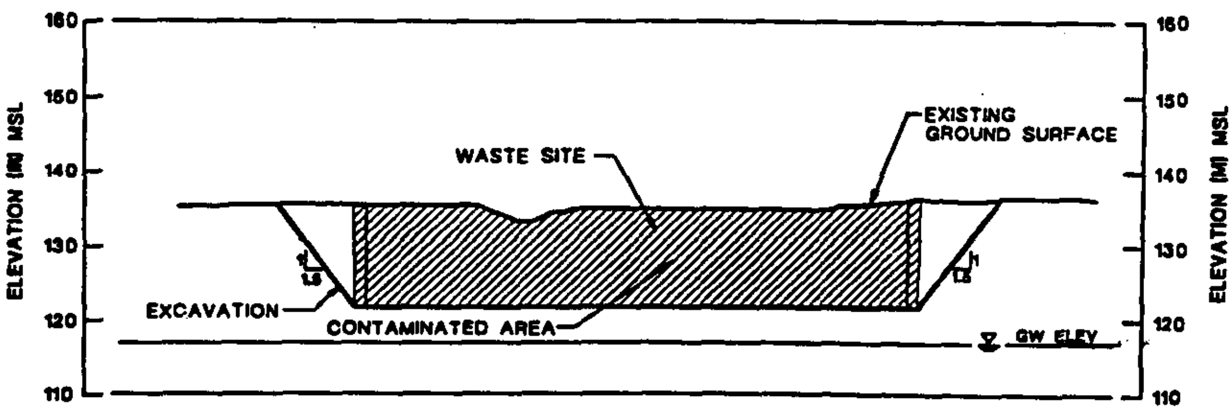


SECTION A

VERTICAL
EXAGGERATION = 2x

EXTENT OF CONTAMINATION

SURFACE AREA = 11,753 sq. meters
VOLUME = 125,760 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 22,514 sq. meters
VOLUME = 217,959 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-DR-1 and 2
SITE NAME: 107-DR Liquid Waste Disposal Trench No. 1 and 2

WASTE SITE DIMENSIONS:

Length - Varies, see attached figure [3]
Width - Varies, see attached figure [3]
Depth - 6.1 m (20 ft) [1,2]
Slopes - 1.0 H : 1.0 V
Orientation - N/A

116-DR-1 and 116-DR-2 are assumed to have been enlarged to make one trench [2].

CONTAMINATED VOLUME DIMENSIONS:

Trench was filled to grade with liquids, side slopes, and substrate are contaminated from 1.8 m (6 ft) to 7.6 m (25 ft) below surface [10].

Length - Varies, see attached figure [10]
Width - Varies, see attached figure [10]
Depth - 5.8 m (19 ft) from 1.8 m (6 ft) to 7.6 m (25 ft)

EXCAVATED VOLUME DIMENSIONS:

See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing:	A.	152,341	B.	152,341	C.	152,338	D.	152,300	E.	152,270
Easting:		573,963		573,998		574,029		574,073		574,055
Northing:	F.	152,315	G.	152,315						
Easting:		574,027		573,963						

Reference Point: Point A is located at the northwest corner of the trench. The points proceed clockwise through Point G. All points indicate a trench bottom coordinate [9].

Volume Estimate
100-DR-1 Operable Unit

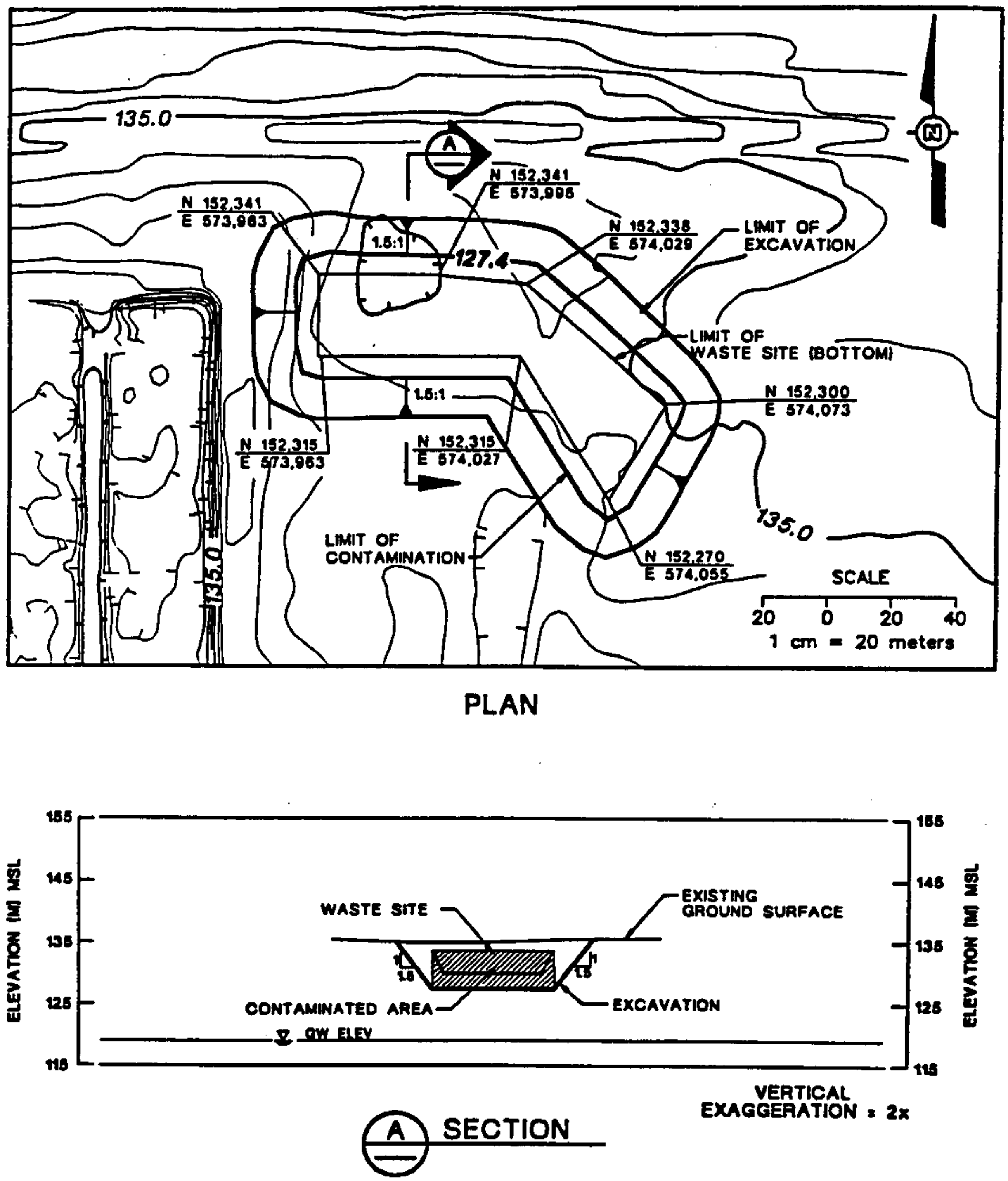
SITE NUMBER: 116-DR-1 and 2 (continued)
SITE NAME: 107-DR Liquid Waste Disposal Trench No. 1 and 2

ELEVATIONS:

Surface: 135.0 m (443 ft) [4]
Groundwater: 116.8 m (383 ft) [8]

Figure 5. IRM Sites: 116-DR-1 and 116-DR-2.

Figure A-5 IRM Site: 116-DR-1 and 116-DR-2



EXTENT OF CONTAMINATION

SURFACE AREA = 4,216 sq. meters
VOLUME = 24,447 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 9,717 sq. meters
VOLUME = 57,846 cu. meters

116DR1-2

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-D-9
SITE NAME: 117-D Seal Pit Crib

WASTE SITE DIMENSIONS:

Length - 3.1 m (10 ft) [1,2]
Width - 3.1 m (10 ft) [1,2]
Depth - 3.1 m (10 ft) [1,2]
Slopes - Vertical
Orientation - North-South [3]

A large steel vent cap is located in the center of the site [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

Length - N/A [10]
Width - N/A [10]
Depth - N/A [10]

EXCAVATED VOLUME DIMENSIONS:

N/A

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 151,536 [9]
Easting: 573,844 [9]

Reference Point: Center of crib [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 116-DR-9
SITE NAME: 107-DR Retention Basin

WASTE SITE DIMENSIONS:

Length - 182.9 m (600 ft) [1,2,3]
Width - 83.2 m (273 ft) [1,2,3]
Depth - 6.1 m (20 ft) [1,2]
Slopes - Vertical
Orientation - North-South lengthwise [3]

CONTAMINATED VOLUME DIMENSIONS:

Contamination extends 60 ft (18.3 m) to the south, 30 ft (9.1 m) to the north, east, and west [10].

Length - 210.3 m (690 ft) [10]
Width - 101.5 m (333 ft) [10]
Depth - 12.2 m (40 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 210.3 m (690 ft) by 101.5 m (333 ft) at a depth of 15.8 m (52 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,336 [9]
Easting: 573,848 [9]

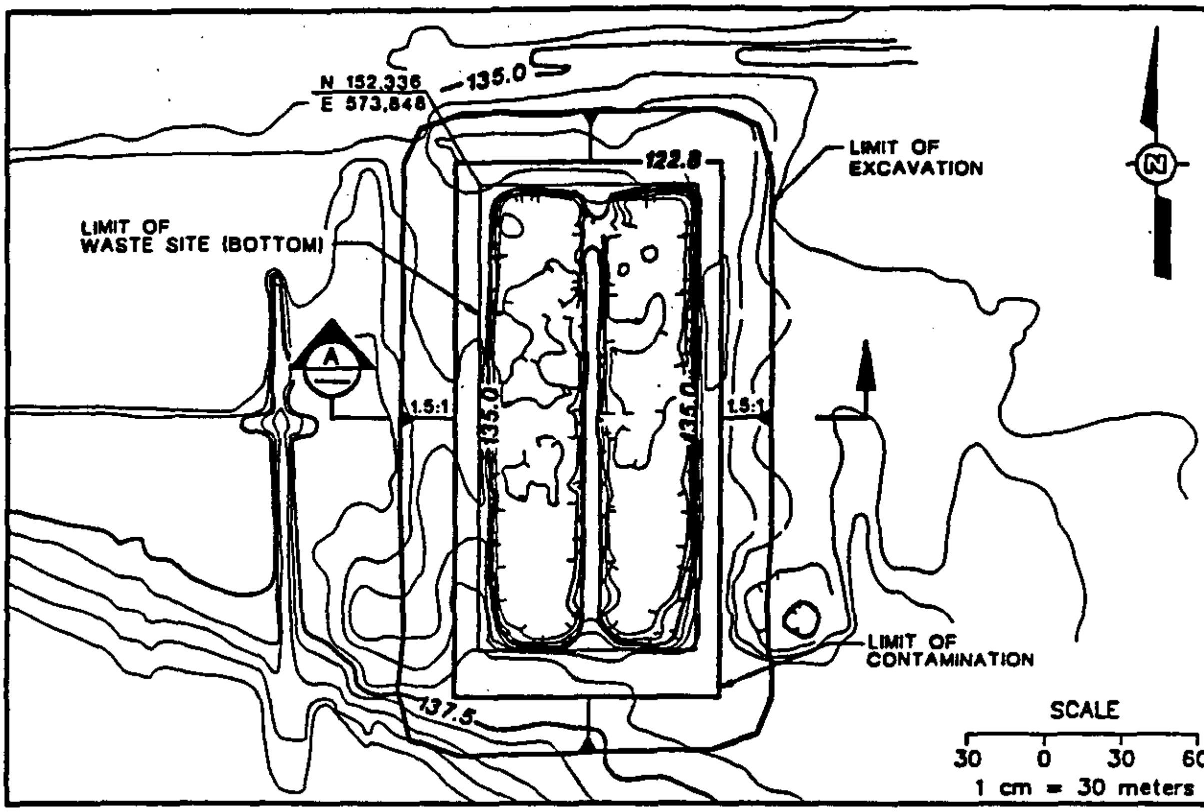
Reference Point: Northwest corner [9]

ELEVATIONS:

Surface: 135.0 m (443 ft) [4]
Groundwater: 116.9 m (384 ft) [8]

Figure 6. IRM Site: 116-DR-9.

Figure A-6 IRM Site: 116-DR-9



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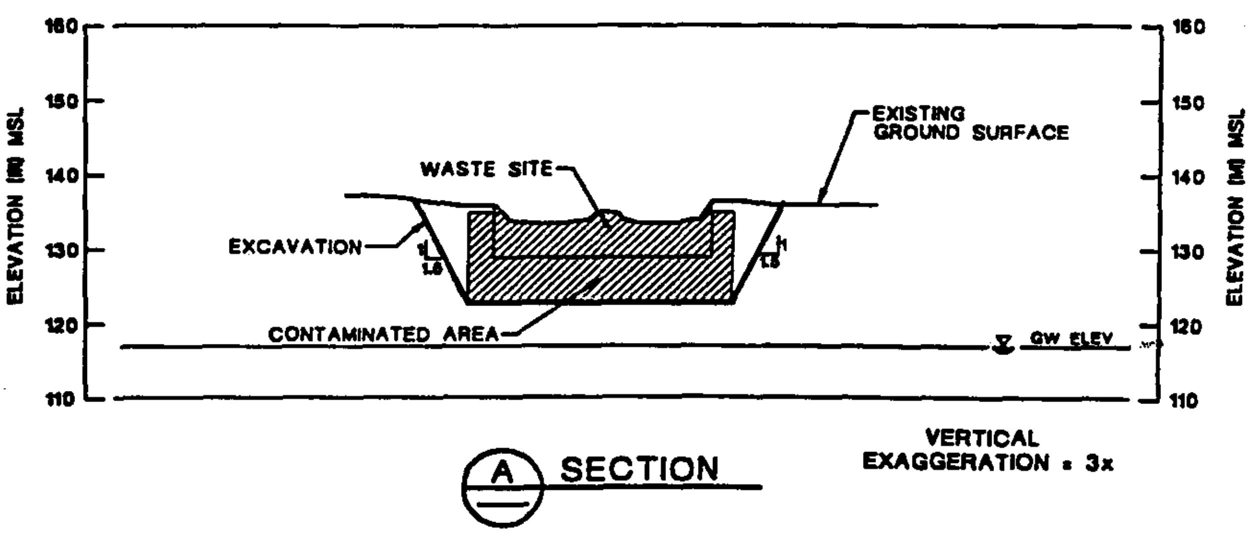


EXTENT OF CONTAMINATION

SURFACE AREA = 21,346 sq. meters
VOLUME = 260,414 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 35,285 sq. meters
VOLUME = 347,671 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 132-D-1
SITE NAME: 115-D Demolished Gas Recirculation Building

WASTE SITE DIMENSIONS:

Length - 51.2 m (168 ft) [1]
Width - 29.9 m (98 ft) [1]
Depth - 3.4 m (11 ft) [1]
Slopes - Vertical
Orientation - North-South lengthwise [5]

The building was demolished in situ and buried 1.0 m (3 ft) below surface [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

Length - N/A [10]
Width - N/A [10]
Depth - N/A [10]

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 151,523 [9]
Easting: 573,785 [9]

Reference Point: Northwest corner [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 132-D-2
SITE NAME: 117-D Filter Building

WASTE SITE DIMENSIONS:

Length - 18.0 m (59 ft) [1]
Width - 11.9 m (39 ft) [1]
Depth - 8.2 m (27 ft) [1]
Slopes - Vertical
Orientation - North-South lengthwise [3,5]

The site was demolished in situ and buried 1.0 m (3.0 ft) below surface [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

Length - N/A [10]
Width - N/A [10]
Depth - N/A [10]

EXCAVATED VOLUME DIMENSIONS:

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 151,521 [9]
Easting: 573,745 [9]

Reference Point: Northeast corner [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER: 132-D-3
SITE NAME: Effluent Pumping Station

WASTE SITE DIMENSIONS:

Length - 6.1 m (20 ft) [1]
Width - 6.1 m (20 ft) [1]
Depth - 9.8 m (32 ft) [1]
Slopes - Vertical
Orientation - North-South

The site was demolished in situ, and covered with 1.0 m (3.0 ft) of backfill [1].

CONTAMINATED VOLUME DIMENSIONS:

Assume no contaminated volume [10].

Length - N/A [10]
Width - N/A [10]
Depth - N/A [10]

EXCAVATED VOLUME DIMENSIONS:

N/A

Excavation Slopes - N/A

WASTE SITE LOCATION:

Northing: 151,551 [9]
Easting: 573,776 [9]

Reference Point: Northeast corner [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D/107-D Sludge Disposal Trench No. 1

WASTE SITE DIMENSIONS:

Length - 32.0 m (105 ft) along the bottom, 38.1 m (125 ft) at top of trench [3]
Width - 9.1 m (30 ft) along the bottom, 15.2 m (50 ft) at top of trench [3]
Depth - 3.1 m (10 ft) [10]
Slopes - 1.0 H : 1.0 V
Orientation - North-South lengthwise [3]

Site was backfilled with 1.8 m (6 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 1.8 m (6 ft) below surface and extends to 5.8 m (19 ft) below surface [10].

Length - 38.1 m (125 ft) [10]
Width - 15.2 m (50 ft) [10]
Depth - 4.0 m (13 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 38.1 m (125 ft) by 15.2 m (50 ft) at a depth of 5.8 m (19 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,285 [9]
Easting: 573,977 [9]

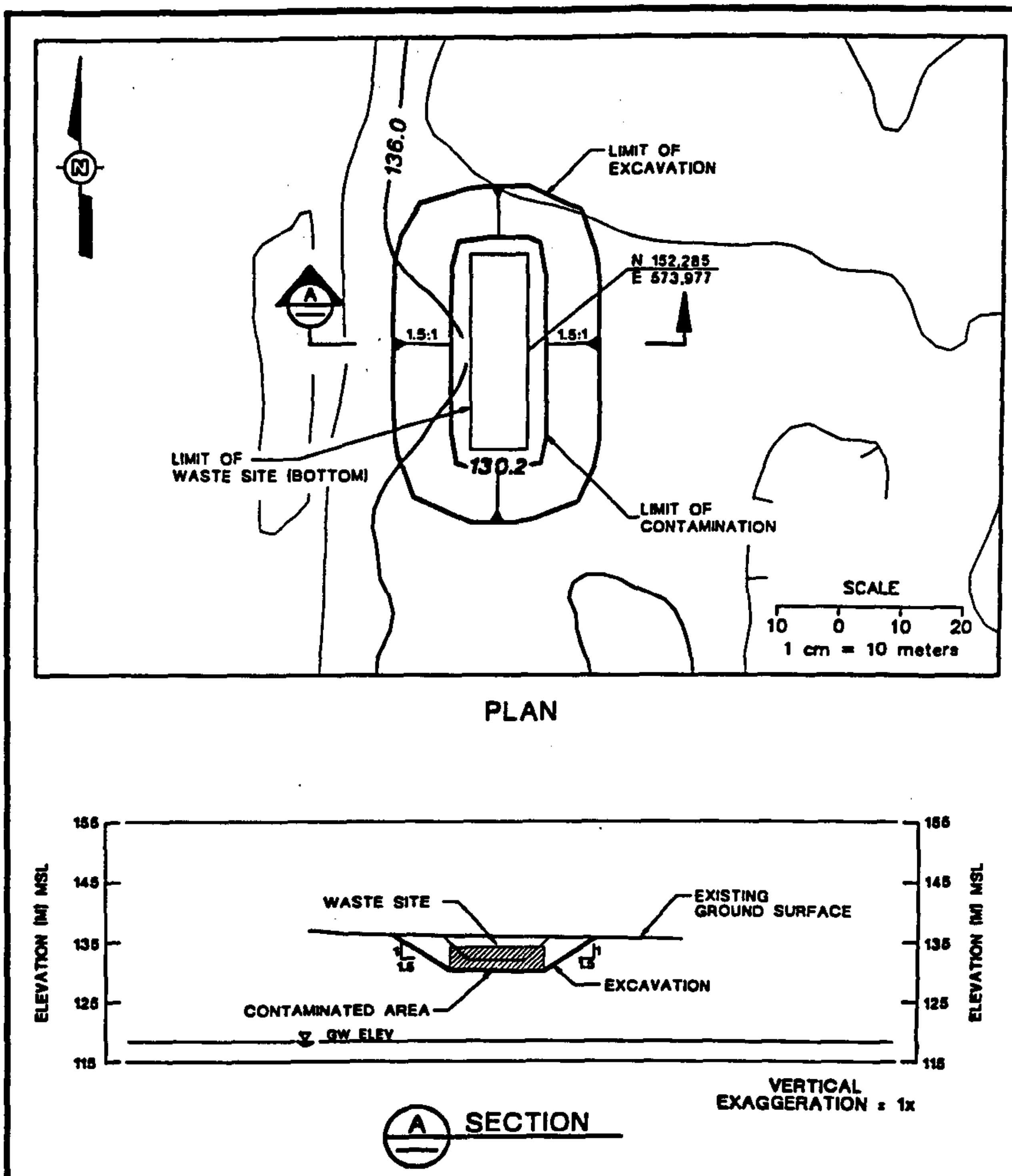
Reference Point: Center of east side of top of trench [9]

ELEVATIONS:

Surface: 135.0 m (443 ft) [4]
Groundwater: 116.8 m (383 ft) [8]

Figure 7. IRM Site: 107-D/DR Sludge Disposal Trench No. 1.

Figure A-7 IRM Site: 107-D/DR Sludge Disposal Trench No. 1



EXTENT OF CONTAMINATION

SURFACE AREA = 652 sq. meters
VOLUME = 2,316 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,635 sq. meters
VOLUME = 6,141 cu. meters

107D1

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D/107-DR Sludge Trench No. 2

WASTE SITE DIMENSIONS:

Length - 32.0 m (105 ft) along the bottom, 38.1 m (125 ft) at top of trench [3]
Width - 9.1 m (30 ft) along the bottom, 15.2 m (50 ft) at top of trench [3]
Depth - 3.1 m (10 ft) [10]
Slopes - 1.0 H : 1.0 V
Orientation - North-South lengthwise [3]

Site was backfilled with 1.8 m (6 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 1.8 m (6 ft) below surface and extends to 5.8 m (19 ft) below surface [10].

Length - 38.1 m (125 ft) [10]
Width - 15.2 m (50 ft) [10]
Depth - 4.0 m (13 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 38.1 m (125 ft) by 15.2 m (50 ft) at a depth of 5.8 m (19 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,312 [9]
Easting: 573,825 [9]

Reference Point: Center of trench [9]

ELEVATIONS:

Surface: 135.0 m (443 ft) [4]
Groundwater: 116.9 m (384 ft) [8]

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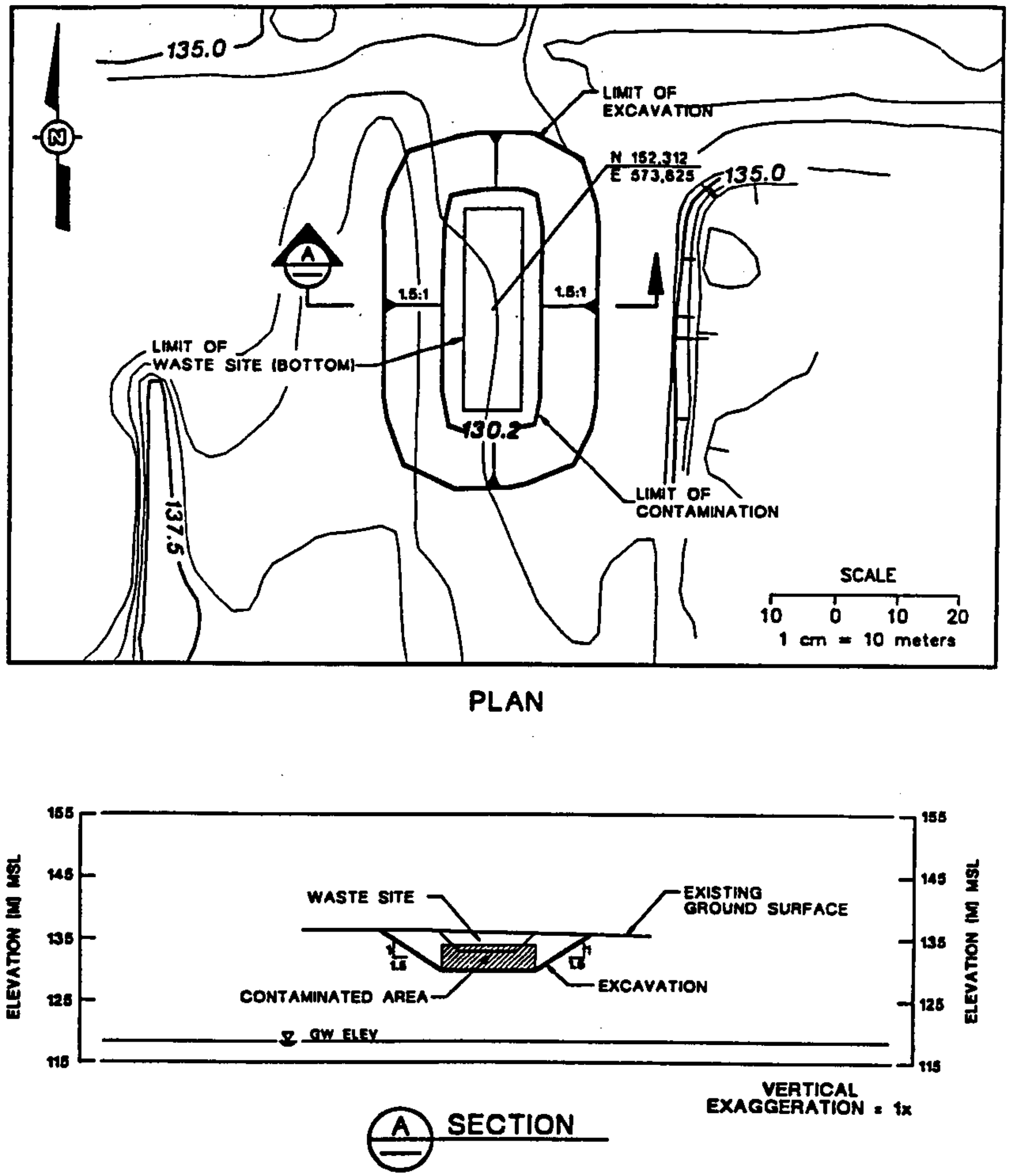
Figure 8. IRM Site: 107-D/DR Sludge Trench No. 2.

Figure A-8 IRM Site: 107-D/DR Sludge Trench No. 2



EXTENT OF CONTAMINATION

SURFACE AREA = 572 sq. meters
VOLUME = 2,315 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,739 sq. meters
VOLUME = 6,731 cu. meters

107D2

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D/107-DR Sludge Trench No. 3

WASTE SITE DIMENSIONS:

Length - 32.0 m (105 ft) along the bottom, 38.1 m (125 ft) at top of trench [3]
Width - 9.1 m (30 ft) along the bottom, 15.2 m (50 ft) at top of trench [3]
Depth - 3.1 m (10 ft) [10]
Slopes - 1.0 H : 1.0 V
Orientation - East-West lengthwise [3]

Site was backfilled with 1.8 m (6 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 1.8 m (6 ft) below surface and extends to 5.8 m (19 ft) below surface [10].

Length - 38.1 m (125 ft) [10]
Width - 15.2 m (50 ft) [10]
Depth - 4.0 m (13 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 38.1 m (125 ft) x 15.2 m (50 ft) at a depth of 5.8 m (19 ft) [10].

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,267 [9]
Easting: 573,734 [9]

Reference Point: Center of north side of top of trench [9]

ELEVATIONS:

Surface: 135 m (443 ft) [4]
Groundwater: 117.0 m (384 ft) [8]

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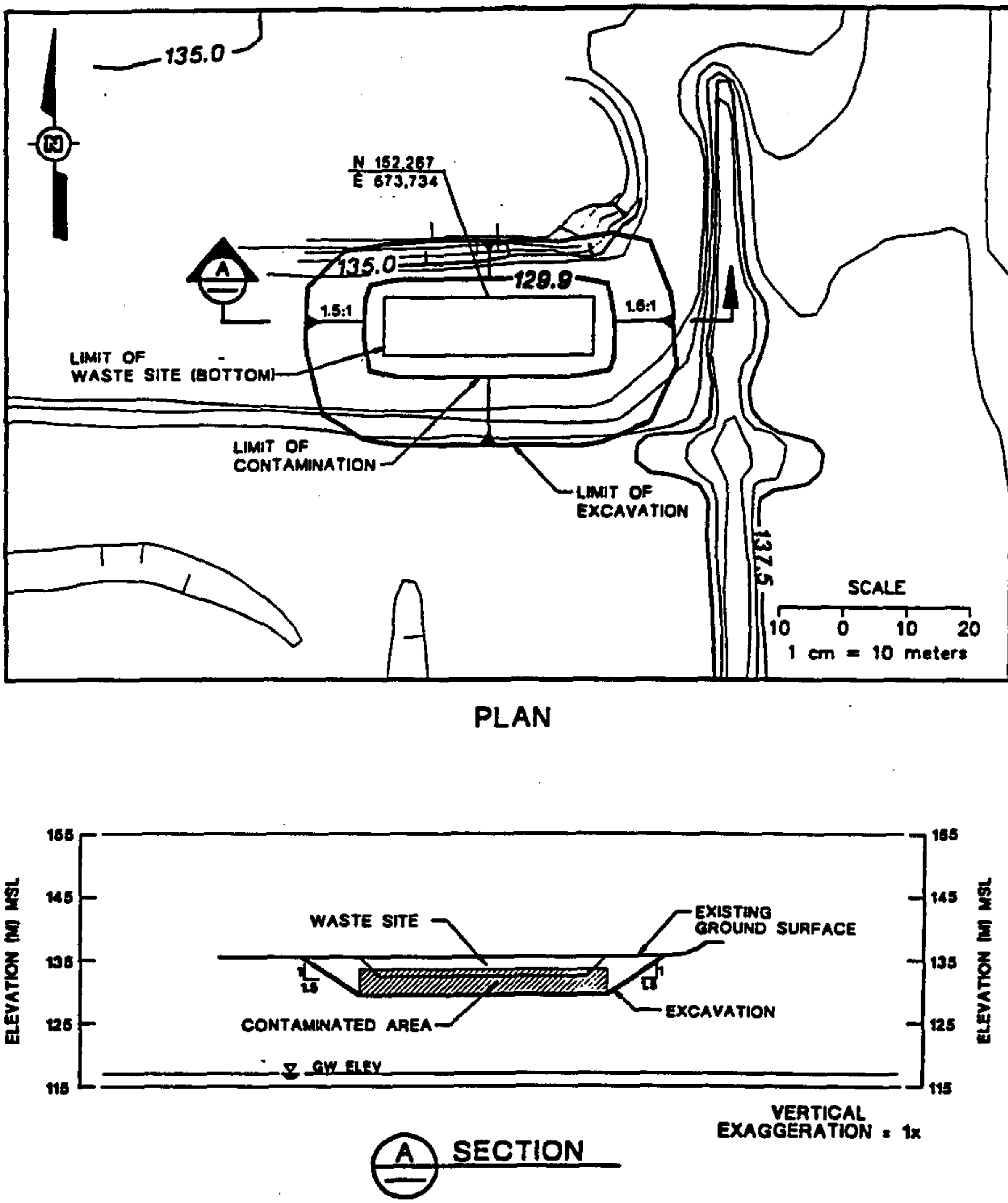
Figure 9. IRM Site: 107-D/DR Sludge Trench No. 3.

Figure A-9 IRM Site: 107-D/DR Sludge Trench No. 3



EXTENT OF CONTAMINATION

SURFACE AREA = 579 sq. meters
VOLUME = 2,316 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,675 sq. meters
VOLUME = 6,495 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D/107-DR Sludge Trench No. 4

WASTE SITE DIMENSIONS:

Length	-	25.9 m (85 ft) along the bottom, 32 m (105 ft) at top of trench [3]
Width	-	6.1 m (20 ft) along the bottom, 12.2 m (40 ft) at top of trench [3]
Depth	-	3.1 m (10 ft) [10]
Slopes	-	1.0 H : 1.0 V
Orientation	-	East-West lengthwise [3]

Site was backfilled with 1.8 m (6 ft) of clean cover.

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 1.8 m (6 ft) below surface and extends to 5.8 m (19 ft) below surface [10].

Length	-	32 m (105 ft) [10]
Width	-	12.2 m (40 ft) [10]
Depth	-	4.0 m (13 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 32.0 m (105 ft) by 12.2 m (40 ft) at a depth of 5.8 m (19 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,357 [9]
Easting: 573,645 [9]

Reference Point: Center of north side of trench [9]

ELEVATIONS:

Surface: 135.0 m (443 ft) [4]
Groundwater: 116.9 m (384 ft) [8]

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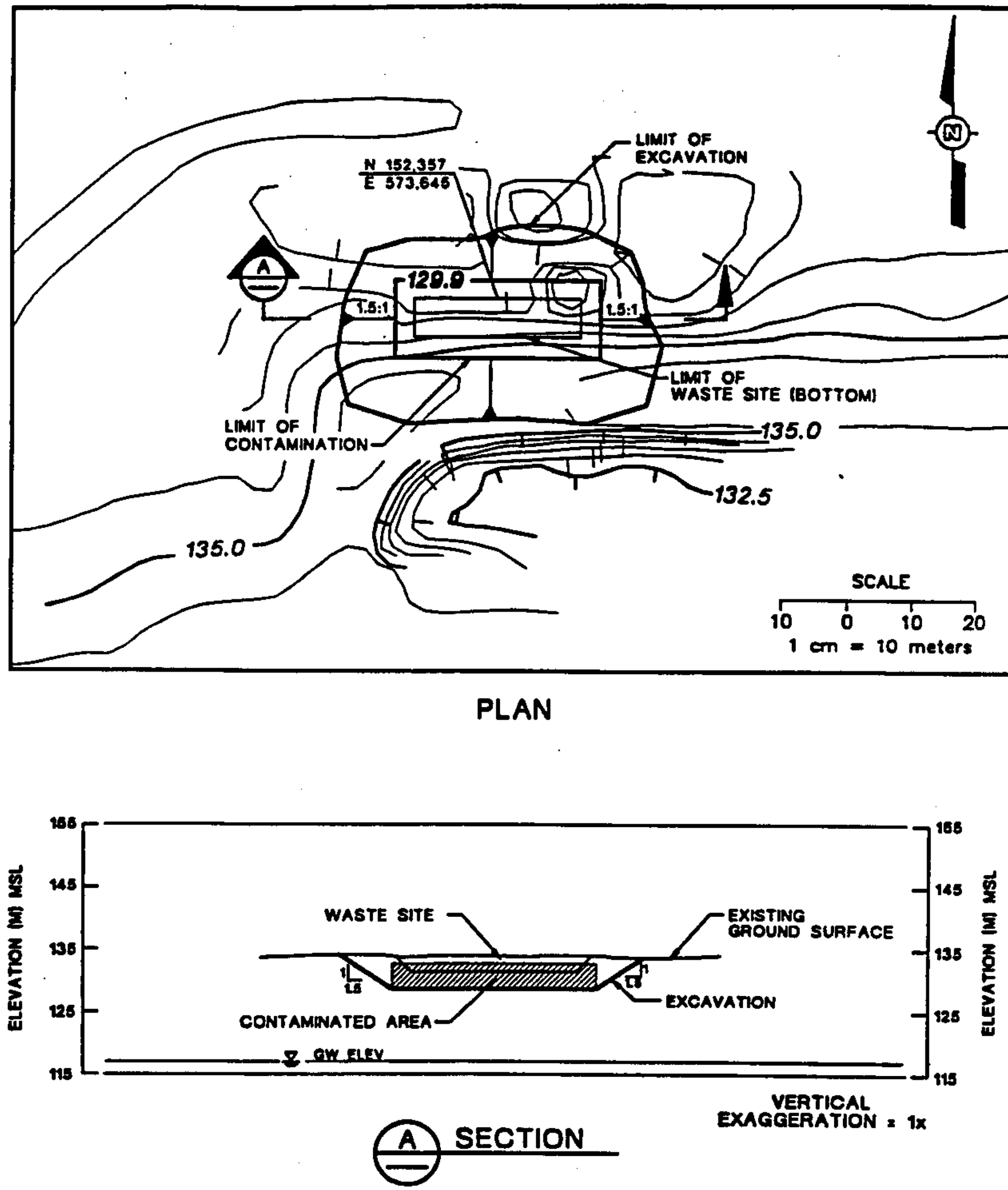
Figure 10. IRM Site: 107-D/DR Sludge Trench No. 4.

Figure A-10 IRM Site: 107-D/DR Sludge Trench No. 4



EXTENT OF CONTAMINATION

SURFACE AREA = 390 sq. meters
VOLUME = 1,561 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,338 sq. meters
VOLUME = 4,615 cu. meters

107D4

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D/107-DR Sludge Trench No. 5

WASTE SITE DIMENSIONS:

Length - 15.2 m (50 ft) along the bottom, 27.4 m (90 ft) at top of trench [3]
Width - 6.1 m (20 ft) along the bottom, 18.3 m (60 ft) at top of trench [3]
Depth - 3.1 m (10 ft) [10]
Slopes - 1.0 H : 1.0 V
Orientation - East-West lengthwise [3]

Site was backfilled with 1.8 m (6 ft) of clean cover.

CONTAMINATED VOLUME DIMENSIONS:

Contamination begins at 1.8 m (6 ft) below surface and extends to 5.8 m (19 ft) below surface [10].

Length - 27.4 m (90 ft) [10]
Width - 18.3 m (60 ft) [10]
Depth - 4.0 m (13 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 27.4 m (90 ft) by 18.3 m (60 ft) at a depth of 5.8 m (19 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 152,205 [9]
Easting: 573,976 [9]

Reference Point: Center of north side of top of trench [8]

ELEVATIONS:

Surface: 136 m (446 ft) [4]
Groundwater: 116.8 m (383 ft) [7]

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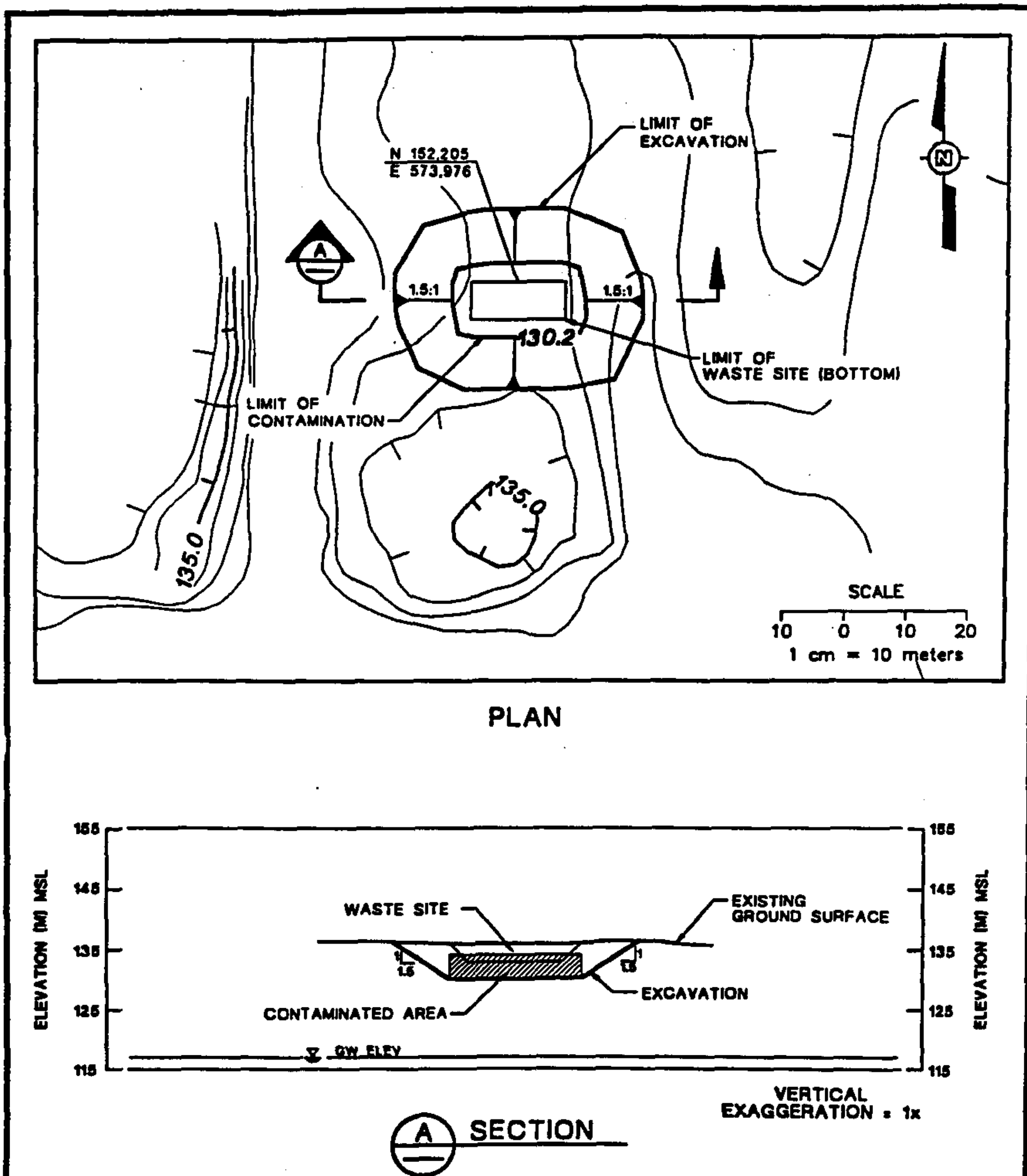
Figure 11. IRM Site: 107-D/DR Sludge Trench No. 5.

Figure A-11 IRM Site: 107-D/DR Sludge Trench No. 5



EXTENT OF CONTAMINATION

SURFACE AREA = 501 sq. meters
VOLUME = 2,005 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,018 sq. meters
VOLUME = 3,493 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 118-D4-A Burial Ground

WASTE SITE DIMENSIONS:

Length	-	45.7 m (150 ft) along the bottom, 57.9 m (190 ft) at surface [3]
Width	-	6.1 m (20 ft) along the bottom, 18.3 m (60 ft) at surface [3]
Depth	-	6.1 m (20 ft) [assumed]
Slopes	-	1.0 H : 1.0 V
Orientation	-	North-South lengthwise [3]

Assume backfilled with 1.5 m (5 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination is volume of trench. Contamination begins at 1.5 m (5 ft) below surface and extends to 7.6 m (25 ft) below surface [10].

Length	-	45.7 m (150 ft) along the bottom, 57.9 m (190 ft) at surface [10]
Width	-	6.1 m (20 ft) along the bottom, 18.3 m (60 ft) at surface [10]
Depth	-	6.1 m (20 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 45.7 m (150 ft) x 6.1 m (20 ft) at a depth of 7.6 m (25 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing:	151,586 [9]	Northing:	151,631 [9]
Easting:	573,847 [9]	Easting:	573,847 [9]
Reference Point:	Southwest corner of surface [9]	Reference Point:	Northwest corner of surface [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

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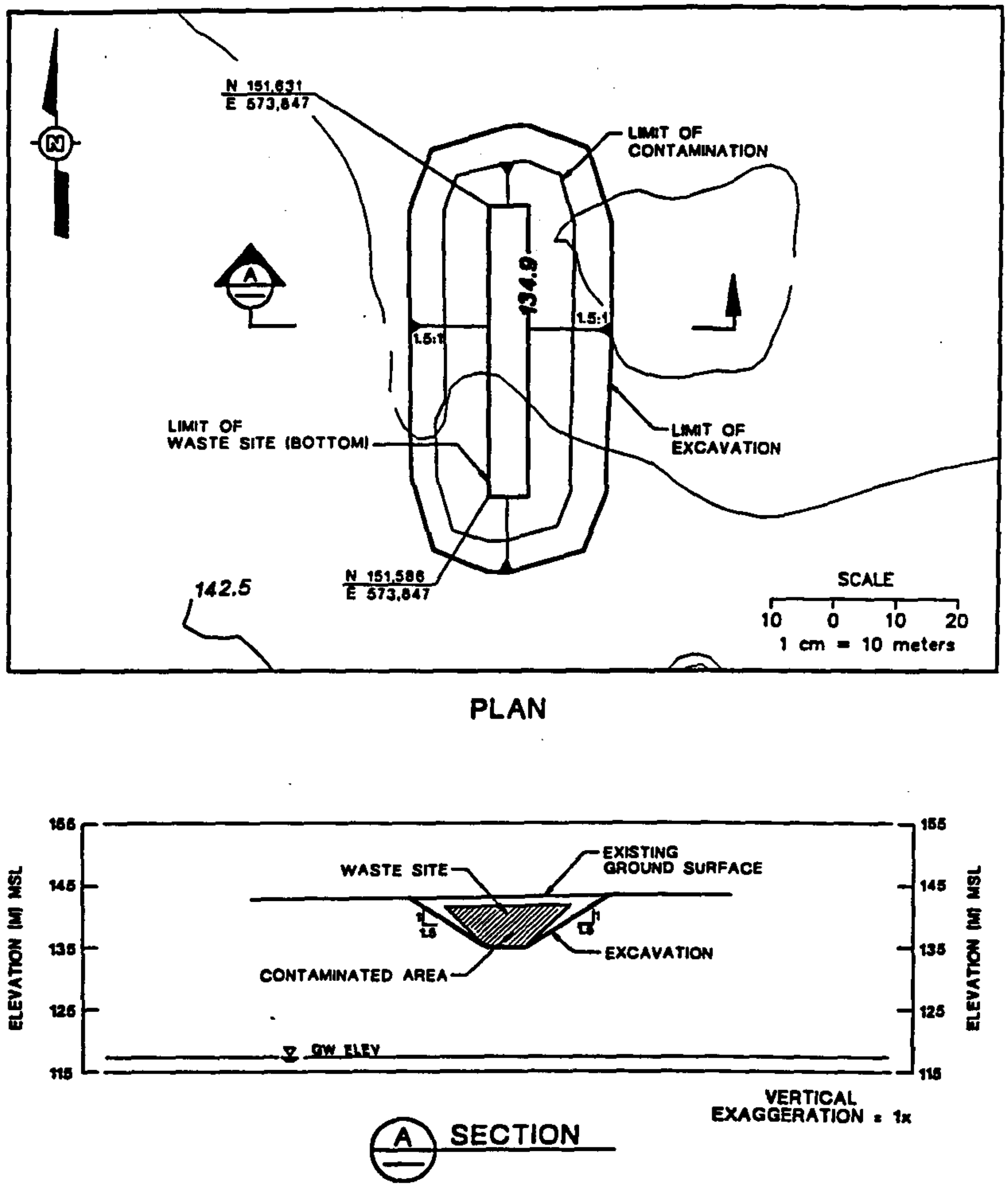
Figure 12. IRM Site: 4A Burial Ground.

Figure A-12 IRM Site: 4A Burial Ground



EXTENT OF CONTAMINATION

SURFACE AREA = 1,059 sq. meters
VOLUME = 4,564 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 1,959 sq. meters
VOLUME = 8,856 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 118-D4-B Burial Ground

WASTE SITE DIMENSIONS:

Length - 24.7 m (81 ft) along the bottom, 32 m (105 ft) at surface [3]
Width - 7.3 m (24 ft) at the surface [3]
Depth - 3.7 m (12 ft) [10]
Slopes - 1.0 H : 1.0 V
Orientation - Long Axis Oriented S 38° W.

Assume a 'V' trench with 3.7 m (24 ft) width at the surface. Site was backfilled with 1.5 m (5 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination is volume of trench. Contamination begins at 1.5 m (5 ft) below surface and extends to 5.2 m (17 ft) below surface [10].

Length - 24.7 m (81 ft) along the bottom, 32 m (105 ft) at surface [10]
Width - 7.3 m (24 ft) at the surface [10]
Depth - 3.7 m (12 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 24.7 m (81 ft) long at a depth of 5.2 m (17 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing:	151,512 [9]	Northing:	151,508 [9]
Easting:	573,831.5 [9]	Easting:	573,835 [9]
Reference Point:	Northwest corner at surface [9]	Reference Point:	Northeast corner at surface [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [8]

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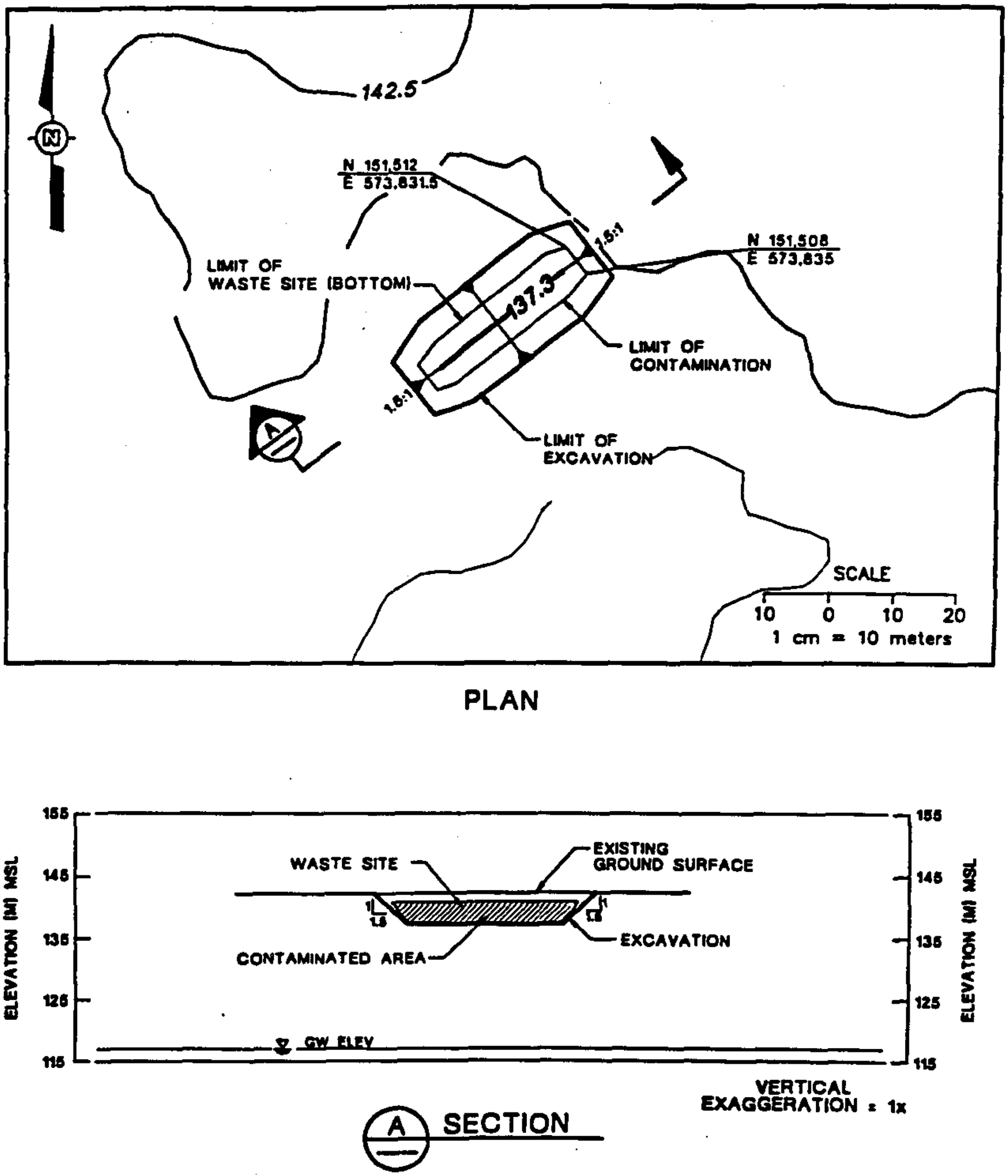
Figure 13. IRM Site: 4B Burial Ground.

Figure A-13 IRM Site: 4B Burial Ground



EXTENT OF CONTAMINATION

SURFACE AREA = 215 sq. meters
VOLUME = 350 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 523 sq. meters
VOLUME = 1,206 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 118-18 Burial Ground

WASTE SITE DIMENSIONS:

Length - 12.2 m (40 ft) along the bottom, 24.4 m (80 ft) at the surface [3].
Width - 12.2 m (40 ft) at the surface [3]
Depth - 6.1 m (20 ft) [10]
Slopes - 1:0 H : 1.0 V
Orientation - North-South lengthwise [3]

Assume a 'V' trench with 12.2 m (40 ft) width at the surface. Site was backfilled with 1.5 m (5 ft) of clean cover [10].

CONTAMINATED VOLUME DIMENSIONS:

Contamination is volume of trench. Contamination begins at 1.5 m (5 ft) below surface and extends to 7.6 m (25 ft) below surface [10].

Length - 12.2 m (40 ft) along the bottom, 24.4 m (80 ft) at the surface [10]
Width - 12.2 m (40 ft) at the surface [10]
Depth - 6.1 m (20 ft) [10]

EXCAVATED VOLUME DIMENSIONS:

Bottom of excavation is 12.2 m (40 ft) long at a depth of 7.6 m (25 ft) [10]. See attached figure for excavation top dimensions.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

Northing: 151,548 [9]	Northing: 151,548 [9]
Easting: 574,001 [9]	Easting: 574,011.5 [9]
Reference Point: Northwest corner at surface [9]	Reference Point: Northeast corner at surface [9]

ELEVATIONS:

Surface: 142.5 m (468 ft) [4]
Groundwater: 117.3 m (385 ft) [7]

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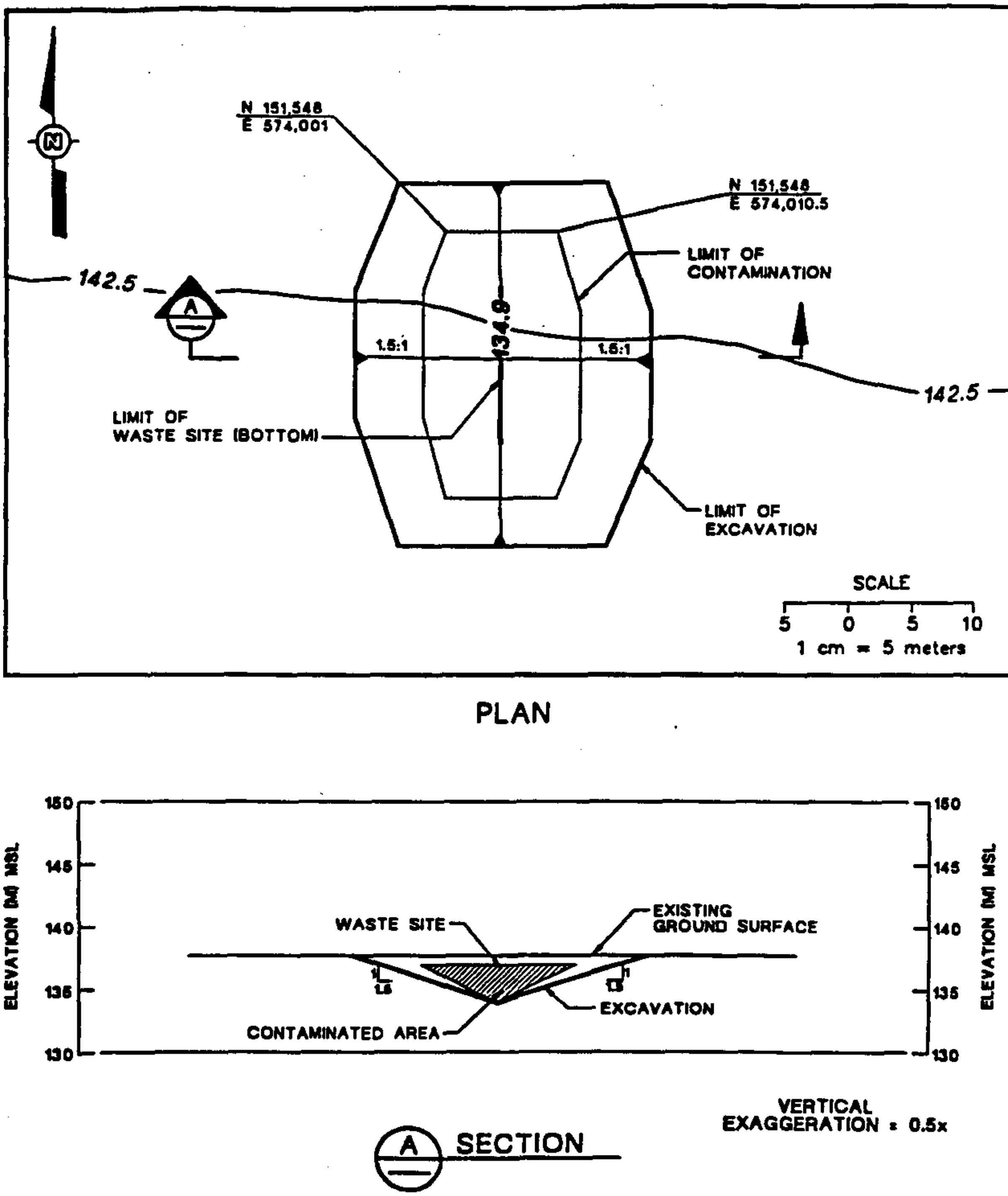
Figure 14. IRM Site: 18 Burial Ground.

Figure A-14 IRM Site: 18 Burial Ground



EXTENT OF CONTAMINATION

SURFACE AREA = 237 sq. meters
VOLUME = 625 cu. meters

EXTENT OF EXCAVATION

SURFACE AREA = 682 sq. meters
VOLUME = 1,826 cu. meters

Volume Estimate
100-DR-1 Operable Unit

SITE NUMBER:
SITE NAME: 107-D & 107-DR Process Effluent Pipelines (soil and sludge)

WASTE SITE DIMENSIONS:

Length - 3,695.4 m (12,124 ft) [3]	Length - 325.5 m (1,068 ft) [3]
Width - 1.5 m (5 ft) diameter [3]	Width - 1.07 m (42 in.) [3]
Depth - Varies [11]	Depth - Varies [11]
Slopes - Varies	Slopes - Varies
Orientation - Varies	Orientation - Varies

Reinforced concrete box 2.06 m (6 ft x 9 in.) x 2.06 m (6 ft x 9 in.) x 9.1 m (30 ft) long.

CONTAMINATED VOLUME DIMENSIONS:

Soil around pipe. No contamination along length of pipe.

Sludge inside pipe. All pipes have contaminated sludge along bottom. Volume of sludge is insignificant, the volume calculated will be that of pipe void.

EXCAVATED VOLUME DIMENSIONS:

Depends on depth of pipe. Base of excavation is 0.61 m (2 ft) on each side of the pipe and begins 7.6 cm (3 in.) below invert of pipe.

Excavation Slopes - 1.5 H : 1.0 V

WASTE SITE LOCATION:

See figure.

ELEVATIONS:

See figure.

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Figure 15. IRM Site: 100 D/DR Pipelines.

Figure A-15 IRM Site: 100 D/DR Pipelines

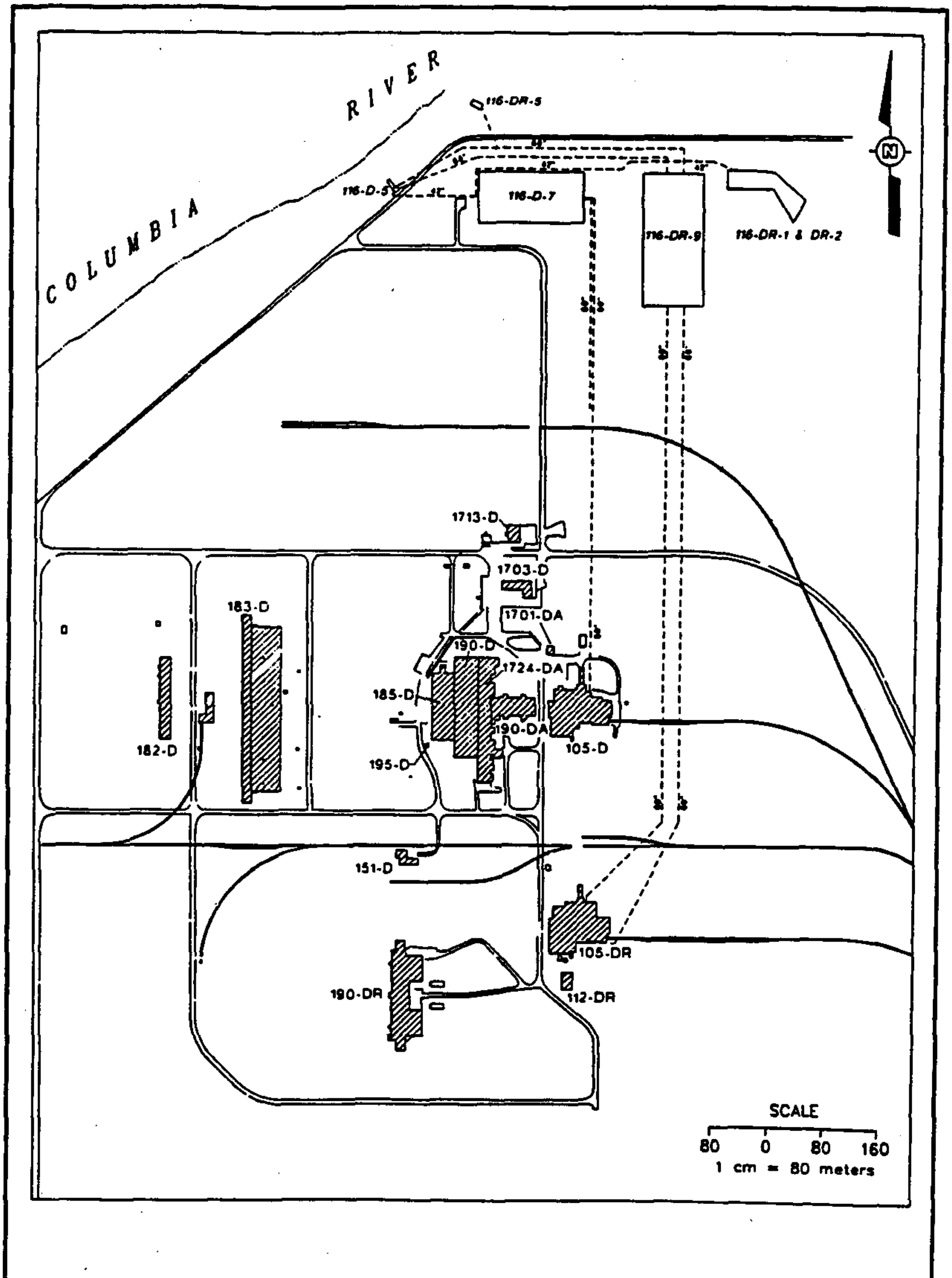
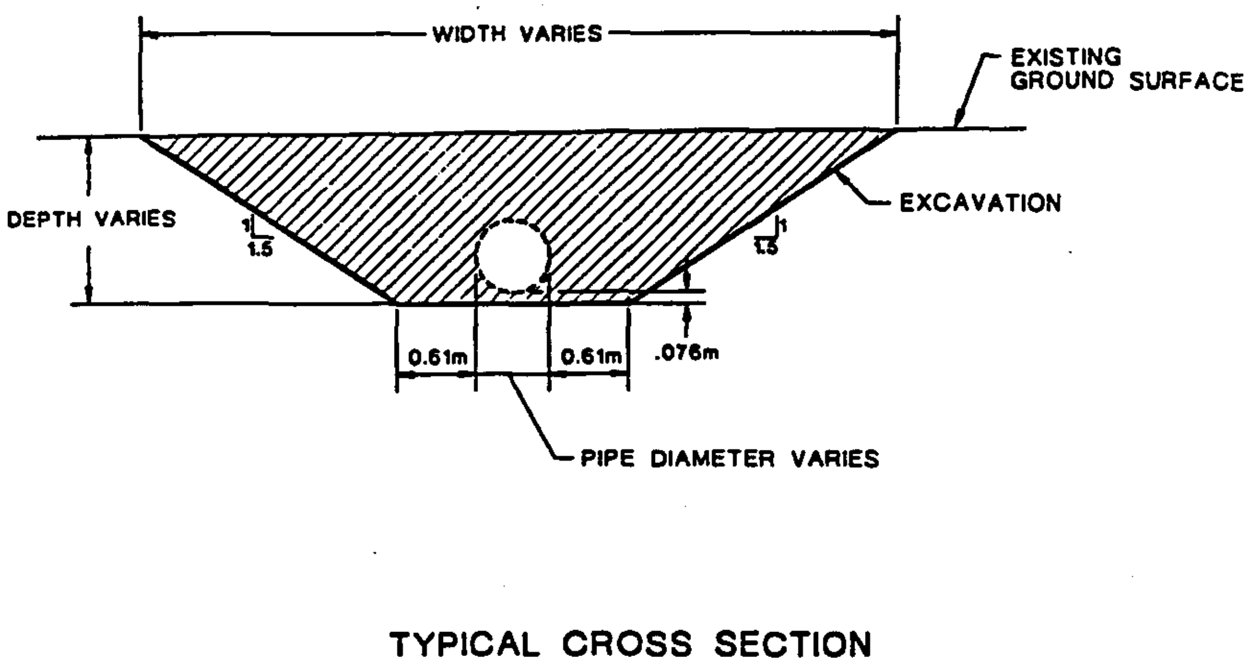


Figure 16. Typical Pipeline Excavation Cross Section.

Figure A-16 Typical Pipeline Excavation Cross Section



PEXSEC

Figure 17. 100 D/DR 42 in. Pipelines.

Figure A-17 100 D/DR 42 inch Pipelines

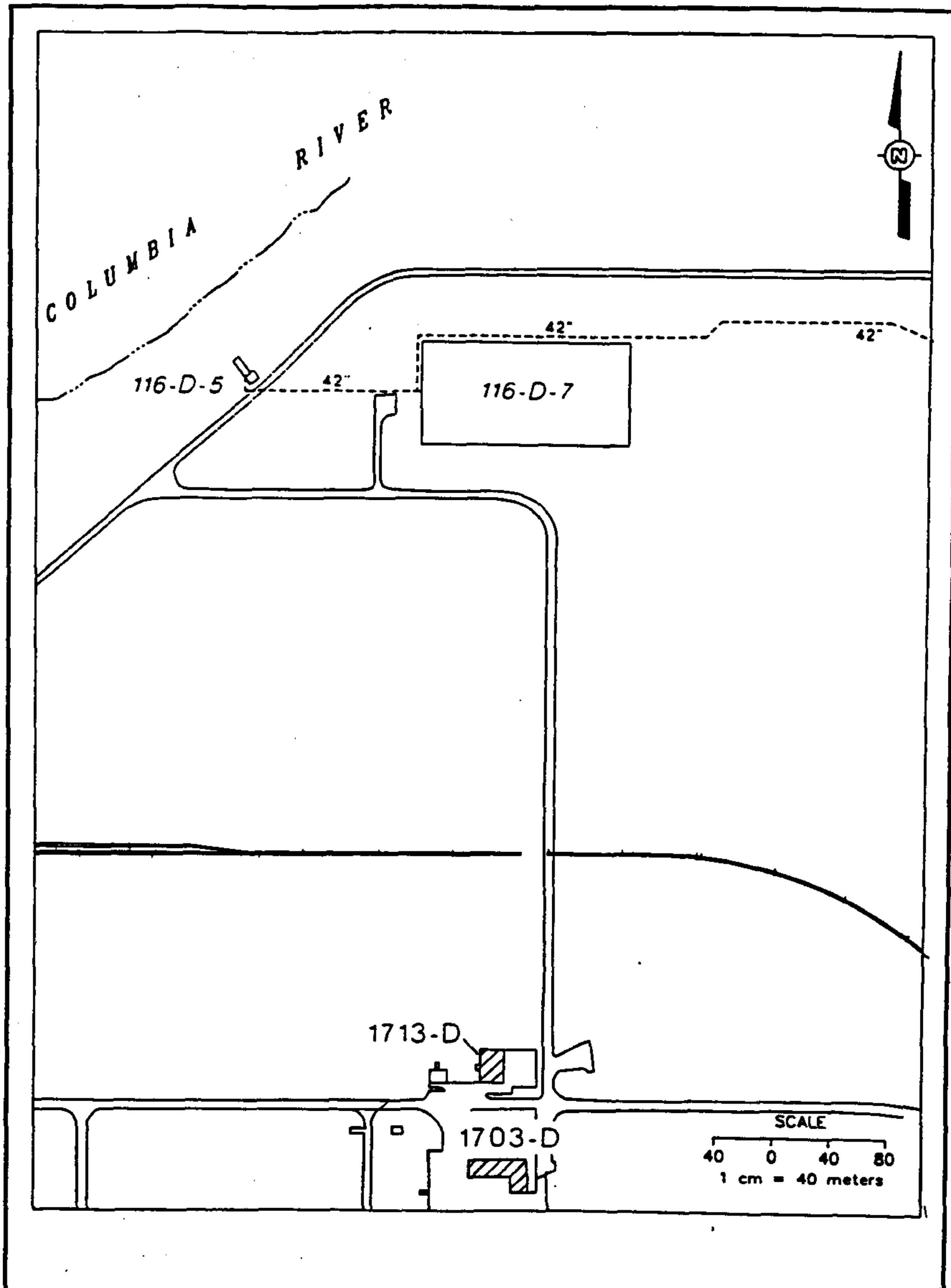
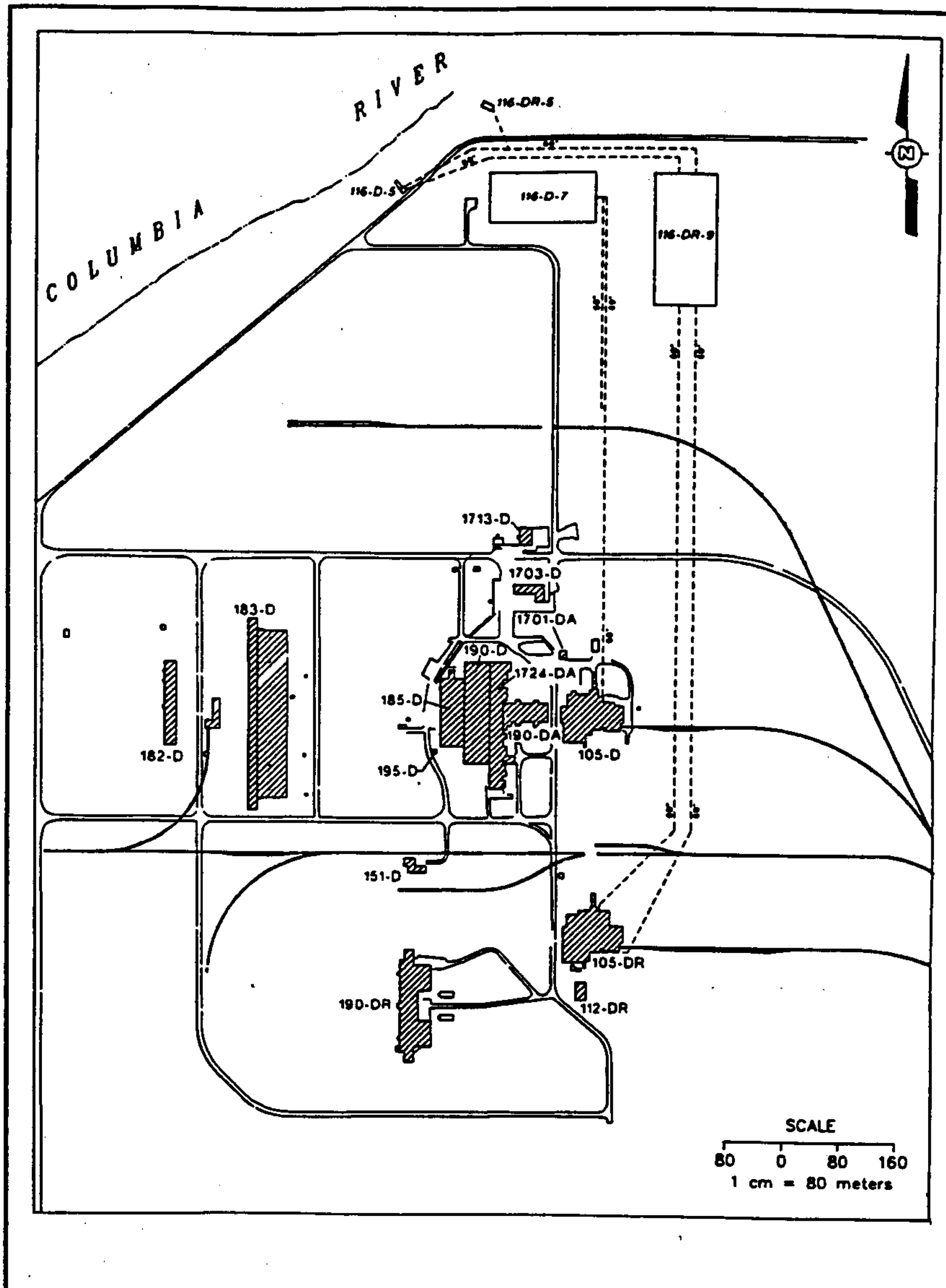


Figure 18. 100 D/DR 60 in. Pipelines.

Figure A-18 100 D/DR 60 inch Pipelines



PLN60D

ATTACHMENT 2

100-DR-1 OPERABLE UNIT WASTE SITE COST ESTIMATES

1.0 COST ESTIMATE SUMMARIES

This appendix has two primary purposes. The first is to describe the cost models developed to support the source operable unit focused feasibility study reports. The second is to document the cost estimates developed for each waste site using the cost models.

1.1 DESCRIPTION OF COST MODELS

A cost model defines the remedial alternative activities and provides a method in which to estimate the associated cost. Each cost model is developed using the MCACES[1] software package.

The focused feasibility study cost models are based on the Environmental Restoration cost models used for developing the fiscal year planning baselines. The Environmental Restoration cost models were modified for the source operable unit focused feasibility studies to include all costs associated with the remedial alternatives. Project Time and Cost, Inc., supported both the baseline and focused feasibility study cost estimating activities. The fourteen cost models associated with the source operable unit focused feasibility studies are presented in the *100 Area Source Operable Unit Focused Feasibility Study Cost Models* (WHC 1994).

All cost models were developed based on a common work breakdown structure. There are three main elements within the structure; Offsite Analytical Services (ANA), Fixed Price Contractor (SUB), and Westinghouse Hanford Company (WHC).[2] Each of the three main elements is defined further by additional levels. Table B-1 describes each element and level of a cost model. The work breakdown structure discussion is applicable for each cost model.

1.2 WASTE SITE COST ESTIMATES

Cost estimates were developed for each waste site addressed by the focused feasibility study based on the applicable cost model. The present worth for each estimate is based on a 5% discount rate and a disposal fee of $70/cubic yard. Due to current uncertainty as to the actual disposal fee, a sensitivity analysis is presented based on $700/cubic yard and $7,000/cubic yard besides $70/cubic yard. A matrix of the waste site, cost estimate table, and cost comparison figure is presented on Table B-2.

[1] MCACES: Micro Computer Aided Cost Estimating System.

[2] The cost model terminology has not been updated to reflect the current change in the environmental restoration primary contractor.

Table B-1. Cost Model Work Breakdown Structure Discussion. (page 1 of 4)

ELEMENTS AND LEVELS	DESCRIPTION
ANA: Offsite Analytical Services	This element represents the offsite contractor performing laboratory analysis of samples.
ANA:02 Lab Analysis	This level includes the laboratory analysis of samples. 10% of routine samples and all quality control samples were assumed to be analyzed using level III and level V analysis. Site certification samples were assumed to be analyzed using level IV and V analysis.
SUB: Fixed Price Contractor	This element represents the remedial activities performed by the fixed price contractor.
SUB:01 Mobilization & Preparatory	This level includes mobilization of personnel and equipment, preparation for temporary facilities, and construction of temporary facilities.
SUB:02 Sample Collection and Monitoring	This level includes in situ monitoring and field sample collections. Assumptions for sampling include one regular sample per 32 cubic yards removed (one per container) and one quality control sample per twenty regular samples. Site certification samples were assumed to be taken at one per 2,500 square feet of bottom area with a minimum of four samples. Additional activities included treatment process sampling which was assumed to be at a rate of one sample per 1,000 cubic yards of feed material.

Table B-1. Cost Model Work Breakdown Structure Discussion. (page 2 of 4)

ELEMENTS AND LEVELS	DESCRIPTION
SUB:08 Solids Collection & Containment	This level includes excavation, capping, dynamic compaction, and personnel training. The excavation activity includes excavation of non-contaminated soil, excavation of contaminated soil, and demolition of solid waste materials. The capping activity includes all steps necessary to construct the appropriate cap layers. The dynamic compaction activity includes the physical compaction and dust suppression. Personnel training included the standard 40-hour course, a fundamentals of radiation safety course, and an 8-hour supervisor course.
SUB:13 Physical Treatment	This level includes both soil washing and solid waste compaction activities such as mobilization/setup, personnel training, operation, system maintenance, demobilization, and pre- and post-treatment plan submittals. Assumptions include a swell factor of 25% for the material being hauled from the excavation. 90% of the contaminated material was assumed to be compactible.
SUB:14 Thermal Treatment	This level includes thermal desorption mobilization/setup, personnel training, system operation, demobilization, and pre- and post-treatment plan submittals. It is assumed that 5% of contaminated soil is organically contaminated and will be thermally treated should organics be present. An additional assumption includes a swell factor of 25% for the material being hauled from the excavation.
SUB:15 Stabilization/Fixation	This level includes in situ vitrification mobilization/setup, personnel training, system operation, demobilization, and pre- and post-construction submittals.

Table B-1. Cost Model Work Breakdown Structure Discussion. (page 3 of 4)

ELEMENTS AND LEVELS	DESCRIPTION
SUB:18 Disposal (Other than Commercial)	This level includes transport to the disposal facility and disposal fees/taxes. Assumptions include a 60% swell factor for demolition waste and a 25% swell factor for soils. Reduction in final volume is achieved and quantified based on specific treatment process. A disposal fee of $70/cubic yard was assumed based on current estimates for initial construction, operations/maintenance, and anticipated expansion of the environmental restoration disposal facility.
SUB:20 Site Restoration	This level includes activities such as load/haul borrow materials, spread/compact borrow and stockpiled materials, revegetation, and irrigation. Assumptions include the availability of on-site borrow materials at no additional charge.
SUB:21 Demobilization	This level includes the demobilization of temporary facilities. Note: Because multiple sites will be cleaned up within an operable unit and a cost for mobilization between sites is already included, no allowance for demobilization is made. Only the cost for removal of temporary utilities, fencing, and decontamination facilities are included.
ERC: Environmental Restoration Contractor	This element represents activities performed by the prime contractor.
ERC:02 Onsite Lab	This level includes mobile laboratory support, quality assurance/safety oversight, and health physics support. 90% of routine soil and solid waste samples were assumed to be analyzed using level III analysis. Routine sampling was assumed to occur at one sample per every 32 cubic yards removed(one per container.)
ERC:08 Solids Collection & Containment	This level includes personnel protection services including equipment, maintenance, and laundry services.

Table B-1. Cost Model Work Breakdown Structure Discussion. (page 4 of 4)

ELEMENTS AND LEVELS	DESCRIPTION
Subcontractor Material Procurement Rate	The materials procurement rate reflects the activities associated with procurement or direct materials, inventories and, subcontracts.
Project Management/Construction Management	This cost accounts for project management, construction management, and office support personnel.
General & Administrative/Common Support Pool	The general and administrative costs consist of indirect costs of activities which benefit the company and can not be identified to a specific end cost objective. The common support pool provides for site-wide services of which the company pays a proportional share.
Contingency	A contingency value is calculated for the various waste site groups based on an evaluation of the various levels, the relative importance of the factor to successful completion of the action, and the probability that the factor will change.
Total, Capital, Annual Operations and Maintenance	The total represents the costs associated with the remedial action. The total cost includes capital and operations and maintenance of a cap. These costs are accounted for through the year 2018.
Present Worth	Present worth is calculated using a 5% discount rate over the life of the activity.

Table B-2. Waste Site Cost Presentation Matrix.

Waste Site	Cost Summary Table	Cost Comparison Figure
116-D-7	Table B-3	Figure B-1
116-DR-9	Table B-4	Figure B-2
116-DR-1/2	Table B-5	Figure B-3
107-D/DR #1	Table B-6	Figure B-4
107-D/DR #2	Table B-7	Figure B-5
107-D/DR #3	Table B-8	Figure B-6
107-D/DR #4	Table B-9	Figure B-7
107-D/DR #5	Table B-10	Figure B-8
116-D-1A	Table B-11	Figure B-9
116-D-1B	Table B-12	Figure B-10
116-D-2A	Table B-13	Figure B-11
Effluent Pipelines	Table B-14	Figure B-12
118-D-4A	Table B-15	Figure B-13
118-D-4B	Table B-16	Figure B-14
118-D-18	Table B-17	Figure B-15

Table B-3. Cost Summary for 116-D-7 Retention Basin.

Cost Element		SS-4	SS-10
ANA: Offsite Analytical Services			
ANA:02	Monitoring, Sampling & Analysis	614,660	1,587,170
SUB: Fixed Price Contractor			
SUB:01	Mobilization & Preparatory	89,570	78,050
SUB:02	Monitoring, Sampling & Analysis	407,140	985,630
SUB:08	Solids Collection & Containment	2,452,840	3,525,920
SUB:13	Physical Treatment	-	12,757,810
SUB:14	Thermal Treatment	-	-
SUB:15	Stabilization/Fixation	-	-
SUB:18	Disposal (Other than Commercial)	32,736,010	23,182,110
SUB:20	Site Restoration	3,953,090	3,728,450
SUB:21	Demobilization	18,740	16,470
ERC: Environmental Restoration Contractor			
ERC:02	Monitoring, Sampling & Analysis	923,060	1,962,000
ERC:08	Solids Collection & Containment	97,430	204,700
Subcontractor Materials Procurement Rate		396,570	442,740
Project Management/Construction Management		6,161,170	7,032,580
General & Administration/Common Support Pool		12,045,090	13,748,700
Contingency		21,562,330	25,623,370
Total		81,457,710	94,875,700
Capital		81,457,710	82,273,340
Annual Operations & Maintenance		0	6,001,124
Present Worth		76,818,633	87,688,233
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-8A/SS-8B/SW-7: In Situ Treatment SS-10/SW-9: Removal/Treatment/Disposal			

Table B-4. Cost Summary for 116-DR-9 Retention Basin.

Cost Element		SS-4	SS-10
ANA: Offsite Analytical Services			
ANA:02	Monitoring, Sampling & Analysis	896,730	2,791,230
SUB: Fixed Price Contractor			
SUB:01	Mobilization & Preparatory	98,320	86,895
SUB:02	Monitoring, Sampling & Analysis	655,060	1,687,645
SUB:08	Solids Collection & Containment	1,488,360	2,701,331
SUB:13	Physical Treatment	-	24,631,614
SUB:14	Thermal Treatment	-	-
SUB:15	Stabilization/Fixation	-	-
SUB:18	Disposal (Other than Commercial)	42,082,870	23,978,104
SUB:20	Site Restoration	5,429,140	4,582,906
SUB:21	Demobilization	19,930	17,686
ERC: Environmental Restoration Contractor			
ERC:02	Monitoring, Sampling & Analysis	1,138,810	3,252,496
ERC:08	Solids Collection & Containment	117,830	367,196
Subcontractor Materials Procurement Rate		497,740	576,862
Project Management/Construction Management		7,729,210	9,282,410
General & Administration/Common Support Pool		15,110,600	18,147,112
Contingency		27,095,250	34,078,290
Total		102,359,830	126,181,775
Capital		102,359,830	101,704,269
Annual Operations & Maintenance		0	7,649,221
Present Worth		95,988,999	113,522,862

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-5. Cost Summary for 116-DR-1 and 116-DR-2 Process Effluent.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	239,970	-	454,680
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	60,360	58,540	66,990
SUB:02	Monitoring, Sampling & Analysis	182,380	78,290	252,650
SUB:08	Solids Collection & Containment	390,200	204,620	444,290
SUB:13	Physical Treatment	-	-	3,646,000
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	23,132,550	-
SUB:18	Disposal (Other than Commercial)	4,691,150	-	2,166,970
SUB:20	Site Restoration	892,390	508,880	676,730
SUB:21	Demobilization	14,910	15,040	15,100
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	325,010	1,843,970	510,700
ERC:08	Solids Collection & Containment	33,410	302,730	50,650
Subcontractor Materials Procurement Rate		454,890	1,751,850	530,620
Project Management/Construction Management		1,056,710	4,184,470	1,254,110
General & Administration/Common Support Pool		2,065,860	8,180,640	2,451,780
Contingency		3,538,470	13,688,940	4,632,870
Total		13,945,720	53,950,510	17,154,130
Capital		13,945,720	30,952,940	13,669,340
Annual Operations & Maintenance		0	7,418,571	3,484,790
Present Worth		13,284,777	48,791,225	16,347,588
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-10/SW-9: Removal/Treatment/Disposal SS-8A/SS-8B/SW-7: In Situ Treatment				

Table B-6. Cost Summary for 107-D/DR Sludge Trench No. 1.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	54,730	-	84,200
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	53,010	50,910	58,770
SUB:02	Monitoring, Sampling & Analysis	20,430	8,990	27,260
SUB:08	Solids Collection & Containment	45,340	26,980	50,180
SUB:13	Physical Treatment	-	-	428,840
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	6,200	-
SUB:18	Disposal (Other than Commercial)	463,360	-	262,490
SUB:20	Site Restoration	127,430	-	109,500
SUB:21	Demobilization	13,910	13,970	13,890
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	56,460	200,060	98,800
ERC:08	Solids Collection & Containment	3,870	30,810	8,440
Subcontractor Materials Procurement Rate		52,810	186,990	69,420
Project Management/Construction Management		125,490	446,900	169,140
General & Administration/Common Support Pool		245,340	873,700	330,660
Contingency		429,140	1,461,980	633,290
Total		1,691,310	5,761,940	2,344,870
Capital		1,691,310	3,526,040	2,076,040
Annual Operations & Maintenance		0	2,235,900	268,830
Present Worth		1,613,327	5,494,069	2,242,807

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-7. Cost Summary for 107-D/DR Sludge Trench No. 2.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	54,730	-	84,200
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	52,930	50,880	58,720
SUB:02	Monitoring, Sampling & Analysis	22,070	10,370	29,110
SUB:08	Solids Collection & Containment	49,220	30,350	54,230
SUB:13	Physical Treatment	-	-	436,620
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	2,425,230	-
SUB:18	Disposal (Other than Commercial)	476,830	-	270,280
SUB:20	Site Restoration	132,560	93,660	114,200
SUB:21	Demobilization	13,890	13,960	13,870
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	58,900	205,630	101,880
ERC:08	Solids Collection & Containment	4,220	31,650	8,790
Subcontractor Materials Procurement Rate		54,570	191,580	71,320
Project Management/Construction Management		129,780	458,000	173,850
General & Administration/Common Support Pool		253,710	895,380	339,880
Contingency		443,160	1,498,270	650,070
Total		1,746,550	5,904,950	2,407,030
Capital		1,746,550	3,614,830	2,130,290
Annual Operations & Maintenance		0	2,290,120	276,740
Present Worth		1,665,934	5,630,268	2,302,000

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-8. Cost Summary for 107-D/DR Sludge Trench No. 3.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	54,730	-	84,200
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	52,970	50,840	58,720
SUB:02	Monitoring, Sampling & Analysis	21,420	9,810	28,360
SUB:08	Solids Collection & Containment	47,670	28,980	52,600
SUB:13	Physical Treatment	-	-	433,300
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	2,402,630	-
SUB:18	Disposal (Other than Commercial)	471,410	-	267,040
SUB:20	Site Restoration	130,520	91,920	112,280
SUB:21	Demobilization	13,900	13,950	13,880
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	56,460	203,770	101,290
ERC:08	Solids Collection & Containment	3,870	31,370	8,790
Subcontractor Materials Procurement Rate		53,870	189,660	70,530
Project Management/Construction Management		127,810	453,440	172,020
General & Administration/Common Support Pool		249,870	886,470	336,300
Contingency		436,730	1,483,370	643,550
Total		1,721,210	5,846,220	2,382,880
Capital		1,721,210	3,578,700	2,109,470
Annual Operations & Maintenance		0	2,267,520	273,410
Present Worth		1,641,802	5,574,331	2,279,000
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-8A/SS-8B/SW-7: In Situ Treatment SS-10/SW-9: Removal/Treatment/Disposal				

Table B-9. Cost Summary for 107-D/DR Sludge Trench No. 4.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	46,310	-	71,570
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	52,020	49,910	57,840
SUB:02	Monitoring, Sampling & Analysis	15,440	7,170	20,250
SUB:08	Solids Collection & Containment	34,990	22,170	38,440
SUB:13	Physical Treatment	-	-	348,180
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	1,699,930	-
SUB:18	Disposal (Other than Commercial)	323,760	-	183,620
SUB:20	Site Restoration	99,060	72,610	86,610
SUB:21	Demobilization	13,760	13,820	13,760
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	45,950	144,670	83,880
ERC:08	Solids Collection & Containment	2,810	21,660	7,030
Subcontractor Maintenance Procurement Rate		39,350	136,190	54,660
Project Management/Construction Management		94,070	325,220	134,140
General & Administration/Common Support Pool		183,920	635,810	262,250
Contingency		323,500	1,063,920	504,020
Total		1,274,960	4,193,090	1,866,250
Capital		1,274,960	2,628,510	1,678,190
Annual Operations &Maintenance		0	1,564,580	188,060
Present Worth		1,216,748	3,999,853	1,786,929

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-10. Cost Summary for 107-D/DR Sludge Trench No. 5.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	50,520	-	75,780
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	52,150	50,000	57,990
SUB:02	Monitoring, Sampling & Analysis	12,520	3,490	17,900
SUB:08	Solids Collection & Containment	27,500	13,360	31,340
SUB:13	Physical Treatment	-	-	367,550
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	1,912,170	-
SUB:18	Disposal (Other than Commercial)	356,970	-	202,430
SUB:20	Site Restoration	95,690	66,420	82,010
SUB:21	Demobilization	13,780	13,830	13,780
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	41,880	160,330	83,520
ERC:08	Solids Collection & Containment	2,110	24,480	7,030
Subcontractor Maintenance Procurement Rates		40,780	150,330	56,430
Project Management/Construction Management		96,510	359,160	138,000
General & Administration/Common Support Pool		188,670	702,160	269,790
Contingency		332,880	1,174,950	519,310
Total		1,311,940	4,630,670	1,922,860
Capital		1,311,940	2,853,640	1,715,420
Annual Operations & Maintenance		0	1,777,030	207,440
Present Worth		1,251,974	4,416,602	1,840,851

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-11. Cost Summary for 116-D-1A Fuel Storage Basin Trench.

Cost Element		SS-4	SS-10
ANA: Offsite Analytical Services			
ANA:02	Monitoring, Sampling & Analysis	134,720	202,080
SUB: Fixed Price Contractor			
SUB:01	Mobilization & Preparatory	48,220	54,020
SUB:02	Monitoring, Sampling & Analysis	90,500	109,850
SUB:08	Solids Collection & Containment	197,440	210,690
SUB:13	Physical Treatment	-	1,110,490
SUB:14	Thermal Treatment	-	-
SUB:15	Stabilization/Fixation	-	-
SUB:18	Disposal (Other than Commercial)	1,296,360	591,070
SUB:20	Site Restoration	327,910	265,790
SUB:21	Demobilization	13,220	13,210
ERC: Environmental Restoration Contractor			
ERC:02	Monitoring, Sampling & Analysis	195,830	261,770
ERC:08	Solids Collection & Containment	16,880	21,450
Subcontractor Maintenance Procurement Rates		144,080	171,920
Project Management/Construction Management		349,570	421,540
General & Administration/Common Support Pool		683,410	824,110
Contingency		1,189,370	1,575,460
Total		4,687,520	5,833,480
Capital		4,687,520	4,883,100
Annual Operations & Maintenance		0	950,380
Present Worth		4,466,689	5,565,137
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-8A/SS-8B/SW-7: In Situ Treatment SS-10/SW-9: Removal/Treatment/Disposal			

Table B-12. Cost Summary for 116-D-1B Fuel Storage Basin Trench.

Cost Element		SS-4	SS-10
ANA: Offsite Analytical Services			
ANA:02	Monitoring, Sampling & Analysis	67,360	101,040
SUB: Fixed Price Contractor			
SUB:01	Mobilization & Preparatory	52,940	58,820
SUB:02	Monitoring, Sampling & Analysis	22,680	31,090
SUB:08	Solids Collection & Containment	47,840	53,780
SUB:13	Physical Treatment	-	569,520
SUB:14	Thermal Treatment	-	-
SUB:15	Stabilization/Fixation	-	-
SUB:18	Disposal (Other than Commercial)	557,520	254,750
SUB:20	Site Restoration	136,920	110,390
SUB:21	Demobilization	13,890	13,900
ERC: Environmental Restoration Contractor			
ERC:02	Monitoring, Sampling & Analysis	66,060	113,390
ERC:08	Solids Collection & Containment	3,870	9,140
Subcontractor Materials Procurement Rate		60,720	79,730
Project Management/Construction Management		144,370	194,180
General & Administration/Common Support Pool		282,230	379,620
Contingency		495,170	728,660
Total		1,951,570	2,698,020
Capital		1,951,570	2,288,570
Annual Operations & Maintenance		0	409,450
Present Worth		1,861,172	2,579,151
SS-3/SW-3: Containment SS-4/SW-4: Removal/Disposal SS-8A/SS-8B/SW-7: In Situ Treatment SS-10/SW-9: Removal/Treatment/Disposal			

Table B-13. Cost Summary for 116-D-2A Pluto Crib.

Cost Element		SS-4	SS-8A	SS-10
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	16,840	-	29,470
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	53,120	45,040	53,600
SUB:02	Monitoring, Sampling & Analysis	1,540	960	1,670
SUB:08	Solids Collection & Containment	6,590	6,040	7,560
SUB:13	Physical Treatment	-	-	171,110
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	225,280	-
SUB:18	Disposal (Other than Commercial)	16,960	-	10,090
SUB:20	Site Restoration	19,870	18,640	19,480
SUB:21	Demobilization	13,110	13,120	13,210
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	10,030	22,110	41,410
ERC:08	Solids Collection & Containment	280	1,550	3,870
Subcontractor Materials Procurement Rate		8,120	22,560	20,200
Project Management/Construction Management		19,440	53,300	51,330
General & Administration/Common Support Pool		38,010	104,190	100,350
Contingency		73,410	174,350	193,640
Total		277,310	687,150	716,990
Capital		277,310	597,530	707,750
Annual Operations & Maintenance		0	89,620	9,240
Present Worth		266,639	660,573	692,246

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-14. Cost Summary for 100 DR Pipelines.

Cost Element		SS-3	SS-4	SS-8B
ANA: Offsite Analytical Services				
ANA:02	Monitoring, Sampling & Analysis	-	218,920	-
SUB: Fixed Price Contractor				
SUB:01	Mobilization & Preparatory	27,900	48,030	17,580
SUB:02	Monitoring, Sampling & Analysis	-	353,030	-
SUB:08	Solids Collection & Containment	13,414,400	1,190,940	1,786,770
SUB:13	Physical Treatment	-	-	-
SUB:14	Thermal Treatment	-	-	-
SUB:15	Stabilization/Fixation	-	-	-
SUB:18	Disposal (Other than Commercial)	-	169,140	-
SUB:20	Site Restoration	1,539,900	1,652,420	-
SUB:21	Demobilization	8,680	11,160	8,630
ERC: Environmental Restoration Contractor				
ERC:02	Monitoring, Sampling & Analysis	583,020	621,440	68,580
ERC:08	Solids Collection & Containment	14,250	87,930	5,450
Subcontractor Maintenance Procurement Rates		1,094,330	250,000	18,130
Project Management/Construction Management		2,502,370	657,610	285,770
General & Administration/Common Support Pool		4,892,140	1,285,640	558,680
Contingency		8,186,180	2,487,580	934,860
Total		32,263,170	9,033,850	3,684,470
Capital		32,263,170	9,033,850	3,684,470
Annual Operations & Maintenance		670,720	0	0
Present Worth		38,143,751	8,606,125	3,509,926

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-15. Cost Summary for 118-D-4A Burial Ground.

Cost Element		SW-3	SW-4	SW-7	SW-9
ANA: Offsite Analytical Services					
ANA:02	Monitoring, Sampling & Analysis	-	12,630	-	12,630
SUB: Fixed Price Contractor					
SUB:01	Mobilization & Preparatory	50190	53490	75820	60410
SUB:02	Monitoring, Sampling & Analysis	-	30430	-	30420
SUB:08	Solids Collection & Containment	447140	75620	500890	75610
SUB:13	Physical Treatment	-	-	-	87220
SUB:14	Thermal Treatment	-	-	-	278830
SUB:15	Stabilization/Fixation	-	-	-	-
SUB:18	Disposal (Other than Commercial)	-	767640	-	446340
SUB:20	Site Restoration	49460	173970	49490	172910
SUB:21	Demobilization	14,030	14,010	14,040	14,010
ERC: Environmental Restoration Contractor					
ERC:02	Monitoring, Sampling & Analysis	28220	52580	50490	66960
ERC:08	Solids Collection & Containment	740	6330	3170	11400
Subcontractor Materials Procurement Rate		40940	81410	46740	85100
Project Management/Construction Management		94610	188320	111090	199380
General & Administration/Common Support Pool		184960	368170	217190	389790
Contingency		309490	675100	363430	714480
Total		1219770	2499700	1432340	2645500
Capital		1219770	2499700	1432340	2508630
Annual Operations & Maintenance		22357	0	25044	136870
Present Worth		1,451,296	2,383,260	1,689,485	2,532,877

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-16. Cost Summary for 118-D-4B Burial Ground.

Cost Element		SW-3	SW-4	SW-7	SW-9
ANA: Offsite Analytical Services					
ANA:02	Monitoring, Sampling & Analysis	-	12,630	-	12,630
SUB: Fixed Price Contractor					
SUB:01	Mobilization & Preparatory	46,280	48,790	59,100	55,690
SUB:02	Monitoring, Sampling & Analysis	-	3,980	-	3,980
SUB:08	Solids Collection & Containment	231,780	12,990	256,110	12,980
SUB:13	Physical Treatment	-	-	-	43,790
SUB:14	Thermal Treatment	-	-	-	208,920
SUB:15	Stabilization/Fixation	-	-	-	-
SUB:18	Disposal (Other than Commercial)	-	63,470	-	36,990
SUB:20	Site Restoration	27,840	37,150	27,860	37,040
SUB:21	Demobilization	13,470	13,360	13,480	13,350
ERC: Environmental Restoration Contractor					
ERC:02	Monitoring, Sampling & Analysis	19,390	16,600	37,960	21,420
ERC:08	Solids Collection & Containment	490	1,060	2,530	1,900
Subcontractor Materials Procurement Rate		23,310	13,120	26,030	30,130
Project Management/Construction Management		54,380	31,580	63,460	69,930
General & Administration/Common Support Pool		106,320	61,730	124,060	136,710
Contingency		177,910	117,090	207,600	253,620
Total		701,190	433,530	818,180	939,070
Capital		701,190	433,530	818,180	915,930
Annual Operations & Maintenance		12,618	0	14,001	23,140
Present Worth		832,107	415,216	961,905	907,466

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

Table B-17. Cost Summary for 118-D-18 Burial Ground.

Cost Element		SW-3	SW-4	SW-7	SW-9
ANA: Offsite Analytical Services					
ANA:02	Monitoring, Sampling & Analysis	-	12,630	-	12,630
SUB: Fixed Price Contractor					
SUB:01	Mobilization & Preparatory	46,710	48,630	59,570	55,560
SUB:02	Monitoring, Sampling & Analysis	-	6,090	-	6,090
SUB:08	Solids Collection & Containment	252,360	17,970	280,020	17,970
SUB:13	Physical Treatment	-	-	-	46,700
SUB:14	Thermal Treatment	-	-	-	213,630
SUB:15	Stabilization/Fixation	-	-	-	-
SUB:18	Disposal (Other than Commercial)	-	110,720		64,390
SUB:20	Site Restoration	29,900	45,760	29,940	45,610
SUB:21	Demobilization	13,530	13,330	13,550	13,330
ERC: Environmental Restoration Contractor					
ERC:02	Monitoring, Sampling & Analysis	19,970	19,040	40,390	24,490
ERC:08	Solids Collection & Containment	490	1,410	2,740	2,530
Subcontractor Materials Procurement Rate		25,000	17,700	27,960	33,820
Project Management/Construction Management		58,200	42,100	68,130	78,620
General & Administration/Common Support Pool		113,770	82,300	133,190	153,700
Contingency		190,380	154,530	222,870	284,560
Total		750,320	572,190	878,370	1,053,630
Capital		750,320	572,190	878,370	1,022,860
Annual Operations & Maintenance		11,589	0	12,806	30,770
Present Worth		865,700	547,269	1,003,895	1,016,567

SS-3/SW-3: Containment
SS-4/SW-4: Removal/Disposal
SS-8A/SS-8B/SW-7: In Situ Treatment
SS-10/SW-9: Removal/Treatment/Disposal

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